

# FIELD ARTILLERY, THE ASCENDING BRANCH OF FORCE XXI

A Monograph  
By  
Major Michael T. Miklos  
Field Artillery



19960617 014

School of Advanced Military Studies  
United States Army Command and General Staff College  
Fort Leavenworth, Kansas

First Term AY 95-96

Approved for Public Release; Distribution is Unlimited

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE		3. REPORT TYPE AND DATES COVERED MONOGRAPH
4. TITLE AND SUBTITLE <i>Field Artillery, the ascending branch of Force XXI.</i>			5. FUNDING NUMBERS	
6. AUTHOR(S) <i>Michael T. Miklos MAJ, US Army</i>				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) School of Advanced Military Studies Command and General Staff College Fort Leavenworth, Kansas 66027			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  Command and General Staff College Fort Leavenworth, Kansas 66027			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT  APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  SEE ATTACHED				
14. SUBJECT TERMS <i>Field Artillery Force XXI Evolution of Technology</i>			15. NUMBER OF PAGES <i>111</i>	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT  UNCLASSIFIED		18. SECURITY CLASSIFICATION OF THIS PAGE  UNCLASSIFIED		19. SECURITY CLASSIFICATION OF ABSTRACT  UNCLASSIFIED
			20. LIMITATION OF ABSTRACT  UNLIMITED	

SCHOOL OF ADVANCED MILITARY STUDIES

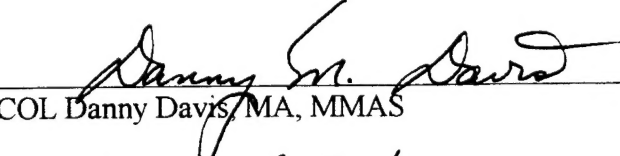
MONOGRAPH APPROVAL

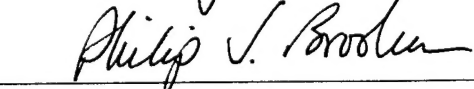
Major Michael T. Miklos

Title of Monograph: Field Artillery, the Ascending Branch of Force XXI.

Approved by:

  
Richard M. Swain, Ph. D. Monograph Director

  
COL Danny Davis, MA, MMAS Director, School of  
Advanced Military  
Studies

  
Philip J. Brookes, Ph.D. Director, Graduate  
Degree Programs

Accepted this 14th day of December 1995

## ABSTRACT

Field Artillery, Ascending Branch of Force XXI. by MAJ Michael T. Miklos, USA, 111 pages.

This study examines the implications of the evolution of technology on the employment of technology of the Field Artillery in Force XXI and beyond. Historically the Field Artillery has been the greatest killer on the battlefield. By 1870, according to J.F.C. Fuller, artillery gained predominance on the field of battle. The influence of technology has also caused the battlefield to continue to expand. Since then, the gradual evolution of technology caused the battlefield to continue to expand, and enabled the artillery system to develop the capability of achieving precision and accuracy. The accuracy allowed the artillery to place lethal fires on targets at extended ranges rather than just fight as an area weapon system.

Since the fall end of the Cold War, the United States has shifted the direction of its military from a threat based force to a capabilities based force. This shift in focus and the development of weapons systems technologies have provided the Army with the opportunity to shift its warfighting paradigm from the primacy of the close battle to the deep battle. It is predicated on fighting primarily with fires rather than fire and maneuver. The paradigm shift will result in new relationships and roles within the branches of the Army and the force structure. This is even more critical as the military continues to develop its emphasis on joint warfare.

In order to execute the new paradigm two events must occur. The first event is the intellectual shift to a new way of fighting. The second event is the continued development of technology. The process must begin in the execution of Force XXI, and continue until the force structure is in place. It is at this time that the shift can occur. Under the new paradigm, the Field Artillery will be placed in its dominate role as the greatest killer on the battlefield.

Structurally, the monograph looks at the current paradigm of combined arms warfare and the role of the field artillery as a force multiplier. It discusses the Force XXI environment and the transition to the new paradigm. Lastly it focuses on conclusions and recommendations for future study.



# TABLE OF CONTENTS

	Page
APPROVAL PAGE.....	i
ABSTRACT .....	ii
TABLE OF CONTENTS.....	iii
ACKNOWLEDGEMENTS .....	iv
CHAPTERS:	
1. INTRODUCTION.....	1
2. CURRENT PARADIGM.....	8
3. FORCE XXI.....	35
4. NEW PARADIGM.....	45
5. CONCLUSIONS.....	55
ENDNOTES .....	59
APPENDIX:	
1. CORPS BATTLEFIELD STRUCTURE.....	78
2. THE FIELD ARTILLERY SYSTEM.....	79
3. THE HEAVY DIVISION ARTILLERY ORGANIZATION.....	80
4. THE CORPS ARTILLERY.....	82
5. INHERENT RESPONSIBILITIES OF FIELD ARTILLERY MISSIONS.....	84
6. MLRS-ATACMS FAMILY OF MUNITIONS.....	85
7. ORGANIZATIONAL CONCEPT MODULAR DIVISION SMALL BASE.....	92
GLOSSARY .....	93
BIBLIOGRAPHY .....	100
INITIAL DISTRIBUTION LIST .....	111

## Acknowledgement

I want to express my sincere gratitude to Major Jeff Springman for the many discussions we had involved the concepts and possibilities of the field artillery and Force XXI. I want to thank Majors Les Knotts and Greg Gardner for their patient review and editing of my work on the proper use of the English language. I want to express my appreciation to the exceptional staff of the Combined Arms Research Library for patiently ordering and researching materials for me. I want to thank the staff of the Directorate of Combat Developments at Forts Sill and Rucker, Task Force 2000, the Battle Command and Depth and Simultaneous Attack Battle Labs for answering my many questions and providing materials. I want to thank my directors, Dr. Swain and LTC Combest for patiently aiming me in the right direction in my quest for knowledge. Lastly, I want to thank my family for their unfailing support during this time.

## CHAPTER ONE

### INTRODUCTION

Through time, the field artillery has earned its title as the King of Battle.

By 1870, according to J.F.C. Fuller, technology had evolved far enough that the artillery assumed the predominant role of the combat arms on the battlefield. Referring to the decisive role of artillery at the battle of Sedan, the British theorist wrote:

A major influence on the art of war derived from the Franco-Prussian War was the growing preponderance of artillery over infantry.... As the cavalry age in war had given way to the infantry, so now was the infantry age giving way to that of artillery.<sup>1</sup>

It seems the field artillery had assumed lethal dominance on the battlefield.

During WWI infantry attacked across no-man's land behind a wall of indirect fire for protection. During WWII the decisive influence of the artillery was again observed. General William E. Depuy summarized the impact of the artillery in that war as he described his job as an infantry commander in Europe. "My job", he wrote, "was to move the artillery's forward observers across France and Germany. I was convinced that [artillery and aerial bombing] provided the firepower that was the margin of superiority in overall combat power that Americans enjoyed."<sup>2</sup> During the Gulf War this trend was revalidated, at least in part. General Gordon R. Sullivan, Army Chief of Staff, recognized the changes technology was bringing to the battlefield. He and Colonel James M. Dubik observed in their book that:

[t]he Gulf War saw an even greater increase in dispersion and improvement in the ability to deliver long-range lethal fires.... MLRS, Apache, Patriot, Lance, ATACMS, Abrams, Bradley -- especially in conjunction with space based platforms, the weapons delivery and maneuver systems of other services, and equipment like the laser designator and the position guidance system -- all confirm that the trend toward increased lethality at greater ranges and increased dispersion of individuals and units are still at work. Furthermore, the trend will result in changes in tactics, organization, doctrine, equipment, force mix, and methods of command - just as it did in the past.<sup>3</sup>

With the lessons learned from the Gulf War, and the fall of the Soviet Union, General Sullivan and the Honorable Togo D. West, Jr., Secretary of Army, saw a need to refocus the Army. Their concept of how the Army changes calls for a systematic, forward-thinking approach toward ensuring that the United States (U.S.) Army is capable and ready in the next century. The vision for these changes is called Force XXI.

Force XXI is the reconceptualization and redesign of the force at all echelons, from the foxhole to the industrial base, to meet the needs of a volatile and ever changing world.<sup>4</sup> Current paradigms are being questioned and re-examined in light of new technologies. In some cases new paradigms are required. Within each of the branches of the Army the evolution is occurring in varying degrees and at varying speeds. The two branches that are central to the combat arms aspect of Force XXI are the aviation and the field artillery.

The current paradigm for the field artillery is based on the combat function of fire support which includes mortars, field artillery, naval gunfire, Army aviation, and air-delivered weapons.<sup>5</sup> **Fires** [my emphasis] is currently considered a support function rather than a function of decision. Fire support is the collective and coordinated

employment of the fires of armed air-, land- and sea-based indirect fire systems, and electronic warfare systems, against ground targets to support land combat operations at both the operational and tactical levels. Fire support also involves the integration and synchronization of fires and its effects to delay, disrupt, or destroy enemy forces, combat functions, and facilities, in pursuit of operational and tactical objectives.<sup>6</sup> This paradigm is based firmly on the concept of support, vice a concept of obtaining decision in battle through the overwhelming execution of fires as the primary combat arm.

This mental model of the employment of the field artillery as a supporting arm and force multiplier has continued since before World War I. For the purposes of this paper, the field artillery is defined as Army or Marine Corps indirect fire systems -- cannon, rocket and missile -- command, control and coordination facilities, and target acquisition resources. Within the fire support function, the field artillery provides a suite of all-weather tactical options over virtually all terrain.<sup>7</sup> It can delay, disrupt, suppress, neutralize, or destroy enemy formations day or night.<sup>8</sup> Commanders employ variants of these effects to set the conditions for maneuver forces, armor and infantry, to destroy the enemy or to dominate terrain. Arguably, commanders may achieve the effects of maneuver by allowing the enemy to move into a disadvantageous position; however, maneuver is rarely effective without firepower and protection.<sup>9</sup> As such, maneuver and firepower are inseparable and complementary dynamics of the battlefield.<sup>10</sup>

While the force commander is responsible for all the combat functions under his control, the central figure in the integration and synchronization of fires is the fire support coordinator (FSCOORD). At the brigade level and above, he is the commander of the direct support artillery unit.

The FSCOORD oversees the execution of the four basic fire support tasks, to :

- Support forces in contact,
- Support the force commander's battle plan,
- Synchronize fire support, and
- Sustain fire support.<sup>11</sup>

The system available to the FSCOORD for the successful execution of the fire support tasks has three parts:

- Fire support command, control, and coordination (C<sup>3</sup>) facilities and personnel,
- Target acquisition and battlefield surveillance, and
- Fire support weapons systems.<sup>12</sup>

The underlying principles of supporting the maneuver arms with fire and giving depth to the battle, have origins which are deeply rooted in the universal military experience.<sup>13</sup> Under the current paradigm, in which artillery provides support to the maneuver commander, these principles may be accurate; however, under Force XXI, and the new paradigm, the artillery does not provide support but fights decisively with fires.

In short, the shift in methodology will be toward fighting primarily with fires, as opposed to fighting with fire and maneuver. The skillful combination of fire and maneuver in consonance with the battlefield conditions of mission, enemy, troops available, terrain, weather, and time (METT-T), provides a vast array of combinations. Army forces maneuver to bring firepower on the enemy, and bring firepower on the enemy in order to maneuver.<sup>14</sup> This balance between fire and maneuver includes, then, both direct and indirect fires from surface and aerial platforms. From his many observations in battle, the noted military historian Brigadier General S. L. A. Marshall, came to the conclusion that fire superiority is the key to mobility. He posited that "[t]he

tactical body which attains to fire superiority by its own sheer merit will never fail for lack of mobility unless it is wholly let down by forces in the rear area. Fire is the key to mobility. To fire is to move. Weapons when correctly used will invariably bring decision."<sup>15</sup>

By achieving decision primarily through fires, friendly formations will have freedom of movement too, because the enemy will be unable to resist. Fighting with fires is, therefore, the collective and coordinated employment of the fires of armed air-land- and sea- based indirect fire systems, and electronic warfare systems, against ground targets to destroy or neutralize enemy forces, combat functions, and facilities in pursuit of operational and tactical objectives. In this case, correctly using the weapons-related technology of the 21st Century will allow force commanders to destroy enemy armies at depth effectively and efficiently, with multiple means, achieving tactical and operational objectives. From the definition of fighting with fires, the commander has an array of options available to destroy the enemy. This monograph will explain in more detail the old and new paradigms for the field artillery from the perspective of the three parts of the current fire support system: fire support command, control, and coordination (C<sup>3</sup>) facilities and personnel; target acquisition and battlefield surveillance; and fire support weapons systems.

This monograph will examine the changing roles of the field artillery in Force XXI. Specifically, it will answer the question, [W]hat are the implications of the evolution of technology on the employment of the field artillery in Force XXI? It is the thesis of this paper that, as the Army continues the evolutionary process into the next century, a change will occur in the current paradigm of fire support based on the technological

capabilities of the Army in the 21st Century. In the 21st Century environment, decisive fires will be precise indirect fires. To address the thesis question properly the monograph will examine the new environment -- Force XXI, the current paradigm, and the new paradigm.

The monograph consists of five sections. Chapter one is the introduction. It briefly examines the relevant background and the question investigated. It addresses the layout of the paper, critical definitions, and delimiters. Chapter two examines the current fire support paradigm. It looks specifically at the three elements of the fire support system as they apply to the field artillery. Chapter three describes Force XXI and its components. Chapter four describes the new paradigm that will result. It will focus on the same three elements of the field artillery as they apply to Force XXI in approximately 2020 and beyond. Chapter five is the conclusion of the paper. It will restate the environment, the current paradigm, and why the new paradigm is relevant. It will also provide recommended areas for further study.

This monograph will not examine four issues that some may feel are related to the primary monograph question. The paper will focus on the field artillery, the unconstrained, indirect fire aspect of fighting with fires. It will not address the role of the field artillery in operations other than war (OOTW), field artillery logistics, light or other specialized divisions, or the budgetary issues related to Force XXI.

The direction of force modernization is contentious. Adding to that already complex issue, the host of "what if" questions relating to whether or not the Army should buy a system or munition would make it impossible to answer the thesis question. Additionally, the cost of the weapons systems, the size of national stockages, and the



individual cost of each round won't be discussed. While they are important in considering the nation's ability to prosecute a war and the duration of the war, those topics are beyond the scope of this paper. If the Government fails to buy or upgrade the equipment projected for Force XXI, then the answer to the thesis question will be that a paradigm shift for the artillery is probably not possible in its entirety; however, the evolution of the artillery will continue.

## **CHAPTER TWO**

### **CURRENT PARADIGM**

*Combined Arms is the 20th Century endstate for warfighting. The dominant trend has been to achieve synchronization of fire and maneuver through a range of doctrinal, materiel, training and organizational innovations.<sup>16</sup>*

*Brigadier General Leo Baxter  
Deputy Commandant of the Field Artillery School*

### **THE FIELD ARTILLERY WITHIN THE COMBINED ARMS TEAM**

The current paradigm of land combat is predicated upon the predominance of the direct fire battle by maneuver forces, for which indirect fires are only force multipliers. The predominance of direct-fire maneuver forces, infantry and armor, in land combat, asserts that the close battle is the primary battle and the locus of decision. Technology has played a significant role in shaping the frontage and depth of the battlefield. Improvements in technology have increased the lethal ranges at which armies can engage and destroy elements of opposing militaries. During the Roman Empire the close battle was settled at the end of a *gladius*. Today the range of an M1 main battle tank exceeds 3000 meters.

Dr. James J. Schneider, Professor of Theory at the School of Advanced Military Studies, examined the period 1750 - 1905 and argued that the frontage of the battlefield, per man, grew from 9.69 kms to 34.5 kms.<sup>17</sup> Not only the frontage but also the depth of the battlefield expanded. During the American Civil War, the area occupied by a modern corps-size unit, approximately 100,000 men, was an average of 25.75 square kms. By WWI, the area occupied had grown to 240

square kms. In WWII the average area was 2,750 square kms. During the October War the area had increased to 4,000 square kms, and by the Gulf War the area was 213,200 square kms. The rough number of soldiers in the area for the Gulf War was 500,000.<sup>18</sup> Dr. Schneider posits that the close-contact battlefield has gradually expanded through the development of various technologies. This expansion in frontage and depth have resulted in the perception of the battlefield growing empty.<sup>19</sup> Today, for close-contact maneuver forces, the dispersion is even greater and lethal ranges of weapon systems provide much greater depth.

In current doctrine, the battalion, the lowest combined arms echelon in the current paradigm, will normally fight enemy forces they can see and shoot at. This defines an area of operations (AO) on a given frontage, extending from less than 100 meters in forests, urban areas, or close terrain, out to about five kms from the battalion direct-fire weapon systems.<sup>20</sup> As the Army continues to look toward the future, the demand for the capability to engage the enemy at greater distances, and to dominate larger areas of terrain decisively will influence force modernization. The influences will manifest themselves through technology in the areas of range, propulsion, munitions effectiveness, and target acquisition.

The influence of technology on the expanding battlefield also affects established perceptions in the approach to training and the employment of weapons systems. New technological capabilities require adjustment in thinking about the future weapons system employment in the paradigm of maneuver forces by the Army's senior leadership. The persistence of an established

paradigm was something that J.F.C. Fuller observed during WWI:

I felt that in the circumstances the G.H.Q. representatives could do little, even had they wanted to, because Sir Douglas Haig was adamant.... He had been brought up to recognize two fighting arms only -- Cavalry and Infantry. All other arms were auxiliary and subordinate; consequently, it was not a question of reason but of predestination that all new arms, aeroplanes, tanks etc. must fall within the auxiliary category. To suggest that tanks should be organised like cavalry was to him unquestionably right. How else could they be organised? If by the will of God they could not be classified as Cavalry or Infantry, they must be an auxiliary arm, and to argue this point with him would have been a sheer waste of time. He was a man as fixed to this idea as a limpet to its rock.<sup>21</sup>

Regardless of weapons systems capabilities, little has changed since WWI to modify the perception of the predominance of direct-action forces in Army doctrine and training; experience, however, has not supported that perception in the Army.

In current doctrine the Army fights as a combined arms team. Warfare using combined arms is the simultaneous application of combat, combat support (CS), and combat service support (CSS) forces toward a common goal.... That goal is to confuse, demoralize, and destroy the enemy [my emphasis] with the coordinated impact of combat power.<sup>22</sup> The Army's capstone manual, Field Manual 100-5 Operations, outlines four primary elements that provide [the combined arms team] the ability to fight: *maneuver, firepower, protection, and leadership*.<sup>23</sup>

Of these four elements, *maneuver* and *firepower* are inseparable and

complementary dynamics of combat power.<sup>24</sup> As complementary elements, maneuver is ineffective without firepower and protection and vice versa. Army forces maneuver to bring firepower on the enemy, and bring firepower on the enemy in order to maneuver.<sup>25</sup> During engagements, elements of the combined arms team maintain security and force protection. This allows the combined arms team to maintain freedom of action.

As a member of the combined arms team, the field artillery (FA) is employed as a combat support arm on the battlefield. While it is recognized as the greatest killer on the battlefield, U.S. Army doctrine states that it is used to enhance maneuver and weight the main effort -- in short FA is a combat multiplier.<sup>26</sup> As the principal fire support element in fire and maneuver, the field artillery fills three roles.<sup>27</sup> It provides close support to maneuver forces, counterfire, and interdiction as required.<sup>28</sup> With the capabilities of the FA, these roles can be employed throughout the battlefield.

## **BATTLEFIELD ORGANIZATION**

Airland Battle doctrine frames the battlefield into an organization of close, deep, and rear operations<sup>29</sup> (see appendix one). Within the battlefield organization, artillery units are capable of performing their roles across all three. Field artillery units are limited in capability only by the range of individual weapon systems. From the enemy's perspective, he is engaged by nonlinear indirect fires from across the battlefield. This makes the battlefield seem seamless and serves to disrupt his decision making cycle. While seamless, primacy in doctrine for the

organization of battles rests in the close (maneuver or direct fire) fight.<sup>30</sup>

## **ARTILLERY SYSTEM**

Under the current paradigm, the artillery contributes to the combined arms victory by accomplishing its mission: to destroy, neutralize or suppress the enemy by cannon, rocket and missile fires, and to assist in integrating all fire support into combined arms operations.<sup>31</sup> As a force multiplier, the field artillery has several additional advantages and disadvantages.

### **ADVANTAGES**

Because of its range capability, and variety of ammunition and fuze combination, the FA adds depth to the battlefield. It gives the commander the ability to extend his span of control and his ability to shape the conditions for later battles and engagements. It also provides the commander the flexibility and agility to lift and shift combat power quickly, and to mass at key places on the battlefield at his discretion. Because of the capabilities of the components of the artillery system, it also provides a vital resource for the maneuver commander in potential, continuous fire support.

### **DISADVANTAGES**

Long recognized as a system of destruction, the artillery is an area weapon with limited precision. To minimize the lack of precision, the field artillery community developed the five elements for accurate predicted fire to compensate for inaccuracies in equipment and operators. The goal was to minimize errors in the ballistic solution, and place first round effects on the target. The five

elements are:

Accurate target location and size,  
Firing unit location,  
Weapon and ammunition information,  
Meteorological information, and  
Computational procedures.<sup>32</sup>

The use of multiple rounds in effect then compensates for the remaining error.

The fielding of the Field Artillery Digital Automatic Computer (FADAC) in the 1960s, allowed the artillery to begin to achieve the five elements of accurate predicted fire, and to improve the accuracy, effectiveness, and responsiveness of indirect fires. Introduced in Vietnam in 1966-67, FADAC provided the artillery with increased accuracy, decreased response time, and allowed gun crews to fire longer missions and hit more targets with less ammunition. By 1969 it was the primary means of computing fire data.<sup>33</sup>

By the 1980's, the Army fielded the TACFIRE computer system that improved the capabilities of the artillery in minimizing the errors in the five elements of accurate predicted fire, and now included an automated tactical fire direction capability. The artillery now had the ability to lift and shift the massed fires of multiple battalions of artillery across the battlefield at the direction of the commander.

Both computers provided the ground gaining commander with improved accuracy of indirect fires and a capability for achieving first round effects on the desired target. They also allowed the commander to automate his attack guidance. This streamlined unit selection, munition, and volleys desired to engage

a specific type of target. Later generation computers, such as the battery computer system (BCS), provided individual piece-to-target ballistic solutions during each corrected volley. This increased the precision, lethality and the area of coverage. Each technological development brought another step in the evolution of the artillery system, and improved the quality achieved in the five elements of accurate predicted fires.

While an improvement in accuracy was achieved, first round effects did not necessarily equate to the capability for first round, destructive fires. It was not until the development of the Copperhead round, which provided for active terminal guidance, that the artillery could begin to hit a point target with precision. Regardless of munition or weapon, current artillery fire requires observation to trigger firing the munitions, adjusting the effects, and assessing the effects. Force XXI artillery may have precise, point target, "fire-and-forget" weapons with extended ranges. This capability negates the observer's responsibility of adjusting the effects of the fire and allows him to engage more targets.

The challenge of placing accurate predicted fire on an enemy target is compounded if the target is moving. A technique used to solve the problem is controlling the firing of the rounds so that they impact at a specific time and place on the target (TOT). Even for an experienced forward observer this can be a challenging problem.

Another disadvantage occurs in fighting a symmetrical opponent or an artillery based army. In these scenarios, the threat of counterfire is high. This threat places our artillery at a disadvantage. Because it has limited ability to



survive enemy attacks, it must move often in an environment where friendly unit locations are acquired easily by the enemy.

The next disadvantage is linked directly to maneuver forces. The artillery is not well suited as a direct fire weapon. If a battery becomes engaged in a direct fire-fight with an infantry fighting vehicle, such as a BMP, a Bradley-type vehicle or a tank, the battery will generally be destroyed unless it conducts a hasty retreat. The high muzzle velocity, flat trajectory, direct fire weapons of the infantry fighting vehicle and tank are superior in speed of loading and target acquisition to the howitzer. However, if a howitzer shell effects an enemy armored fighting vehicle, the 155mm round will generally cause enough damage to the crew and vehicle that the artillery section/battery can escape. In a nonlinear battlefield, where forces become intermingled, attack by enemy vehicles is a decided detriment to the artillery's ability to provide continuous fires.

The last disadvantage is in the area of mobility. The systems of the infantry and armor ground gaining arms are more mobile than their supporting artillery. The Bradley Fighting Vehicle (BFV) and the Abrams tank are much faster than the M109A2/3 and the M109A5/6, and have greater cross country trafficability.<sup>34</sup> Part of the disadvantage is caused by vehicle age and design limitations. The BFV and the Abrams are much newer weapons systems and technologies.

## **EMPLOYMENT**

The artillery system may be employed as part of an Army force (ARFOR) or as part of a joint command, such as a joint task force (JTF).<sup>35</sup> Given its

advantages and disadvantages, the artillery system performs its three roles (close support, interdiction, counterfire) to dominate the battlefield with indirect fires (see appendix two). It executes the four tasks to focus combat power (support forces in contact, support the force commander's battle plan, synchronize fire support, and sustain fire support) within each of the three roles, and then employs the three parts of the system (fire support command, control, and coordination (C<sup>3</sup>) facilities and personnel; target acquisition and battlefield surveillance; and fire support weapons systems) to accomplish its doctrinal mission. Massing the combat power of the artillery system to maximize its advantages and minimize its disadvantages within an uni-Service command or a JTF requires flexibility in force structure. The division and corps artilleries provide that flexibility.

## **ORGANIZATIONS**

The Army field artillery force structure is built upon the division artillery (DIVARTY) and the corps artillery. The DIVARTY is the largest fixed-structure field artillery organization. In addition to the headquarters and headquarters battery, it contains a direct support battalion for each maneuver brigade of the division, a general support MLRS battery, and a target acquisition battery (see appendix three).

The corps artillery is a command and control headquarters. It has no fixed-structure and is built with attached FA brigades (see appendix four).<sup>36</sup>

## FIELD ARTILLERY IN JOINT OPERATIONS

In the current security environment, Army elements may work as part of a joint force. On these occasions, a division or a corps will have to operate within provisions of joint doctrine.<sup>37</sup> Joint fire support doctrine is predicated on a theme of successful delivery of fires in support of joint operations. Success depends upon the synchronization of all forms of fire support [not just Army assets]... for the purpose of placing the correct type and volume of fire, at the right time and place, to ensure the success of the forces commander's battle plan.<sup>38</sup>

In order to plan and execute effective joint fire support, planners and commanders must understand the relationship between fire and maneuver. This is also the basis of Army doctrine.<sup>39</sup> Joint doctrine addresses universal joint tasks at the theater, operational, and tactical levels.

At the theater level, there are two subordinate fire support tasks: to process theater strategic targets, and to attack theater strategic targets.<sup>40</sup> At this level the employment of field artillery resources is limited, because of range requirements, to ATACMS fires.

At the operational level, there are also two subordinate fire support tasks: to conduct joint force targeting, and to attack operational targets.<sup>41</sup> At this level, the field artillery at the corps-level, has limited ability to acquire targets. Field artillery acquisition assets are limited to aerial observers with aviation brigades and weapons locating radars (WLRs). The ability to prosecute operational targets by the field artillery is limited to rocket and missile fires.

The tactical level of joint operations has three fire support tasks: to

process targets, to engage targets, and to integrate tactical firepower.<sup>42</sup> These tasks are the same as those used by the corps and divisions in uni-service operations.

The implication of joint service operations for the field artillery is the fact that artillery may have to respond to targets originating at the force or other component levels. Additionally, artillery systems may be limited by the need to accommodate other joint force requirements, such as limiting ATACMS trajectories to accommodate air components. Each theater and operation will require a tailoring by planners to meet the intent of the CINC, ground component commander (GCC), or JTF commander for the employment of artillery.

### **Command**

The command of the artillery follows three basic principles. First, *the artillery system must operate as one force*. This implies that all three parts of the artillery system must work with a unity of effort and purpose. Second, *the artillery system must be responsive to the needs of the force commander*. All elements of the artillery system must be responsive to the commander's representative, the FSCOORD. It is his responsibility to ensure that all artillery assets are effectively and efficiently coordinated and synchronized. To accomplish full synchronization, all elements must be subordinate. The unity of effort under the FSCOORD's direction dovetails with the last principle, *direction of the fire support system is the responsibility of the field artillery commander*.<sup>43</sup> The FSCOORD accomplishes his responsibilities by applying the four artillery tasks, in accordance with the

maneuver commander's plan, to ensure maneuver forces have responsive, accurate, and timely indirect fires. In order to execute the plan, the commander and the FSCOORD must have control of the fire support resources, and the correct control measures to efficiently and effectively control all fire support resources.

Field Manual 101-5-1, Operational Terms and Graphics, defines control measures as, "[d]irectives given graphically or orally by a commander to subordinate commands in order to assign responsibilities, coordinate fires and maneuver, and to control combat operations." <sup>44</sup>

### **COORDINATION & CONTROL**

The division and corps artillery FSCOORDs accomplish the second half of the artillery mission, which is to assist in integrating all fire support into combined arms operations, through the use of fire support elements (FSE) at battalion-level and above. It is the FSE's responsibility to ensure that the appropriate coordination and control procedures are in place for the execution of the four artillery tasks.<sup>45</sup> The synchronization of the artillery tasks is centralized through organization for combat.<sup>46</sup>

Organizing for combat is a two step process. Step one is the *establishment of Command Relationships*. Step two is the *assignment of Tactical Missions*.<sup>47</sup> The objective of the FA organization for combat is to ensure that each FA unit is in a tactical organization and is assigned a tactical mission. The FSCOORD recommends a Field Artillery organization for combat to the maneuver commander based upon METT-T.<sup>48</sup>

Five fundamentals are used to organize the artillery for combat:

- Adequate FA support for committed combat units;
- Weight the main attack in the offense and most vulnerable area in the defense;
- Facilitate future operations;
- Immediately available FA support for the commander to influence the action; and
- Maximum feasible centralized control.<sup>49</sup>

Based upon the METT-T analysis, conducted by the FSCOORD, each of the five fundamentals may be adjusted for mission, ammunition, or positioning to compensate for nonstandard missions. To ensure unity of effort, the artillery system uses a common delineation of responsibilities. The delineation of seven inherent responsibilities (to prioritize response to calls for fire, to delineate zones of fire, to furnish fire support teams, to furnish liaison, to establish communications, positioning and fire planning) is used throughout the Army. The responsibilities are based on the tactical mission, and assume the battle will be determined in the close fight (see appendix five for a break down of the seven inherent responsibilities). The last fundamental of organizing for combat focuses on maintaining control at the highest force level consistent with the fire support capabilities and requirements of the overall mission.<sup>50</sup> In addition to organizing for combat, the artillery system uses two methodologies to control the employment of fighting with indirect fires - positive and procedural.

Positive control of indirect fires is established through direct observation of the fall of shot by an observer. This method of control is used primarily by forces in-contact and in the reactive counterfire battle. It may be employed on planned or targets of opportunity. Prior to employing indirect fire assets on any target in

proximity to maneuver forces, the force commander must clear the mission.

Within the positive control aspect of fires, different techniques become very effective in killing the enemy, such as controlling the time the rounds impact on the target (TOTs) and controlling the time-of-opening-fire in the initial call for fire. These techniques raise the forward observer's (FO) confidence level that the fires will hit the enemy at a specific place on the ground and at a certain time. Through these techniques the FO is able to achieve massed effects on the enemy instead of chasing him across the battlefield with indirect fires.

Procedural control of indirect fires allows for a balance between responsiveness and force protection. It is implemented through establishing battlefield geometry, fire support coordination measures, time and distance, and prioritization.

Battlefield geometry is established by delineation of unit boundaries.

Fire support coordination measures (FSCMs) are identified as permissive or restrictive, and are designed to facilitate the rapid engagement of targets and at the same time provide safeguards for friendly forces.<sup>51</sup> When conducting joint, combined, and joint-combined operations, the intent and implementation of FSCMs must be verified, as local commanders may deviate from authoritative doctrine to meet the requirements of their theater. Situations requiring verification include multinational operations, or exercises with members of long standing collective defense agreements such as NATO in an area outside of NATO like Korea. Some of these organizations may already have standardization agreements for interoperability.

An example of a situation which resulted in deviations from the current doctrinal intent occurred during the Gulf War and involved the fire support coordination line (FSCL). In Army and Joint Doctrine, the FSCL is a permissive FSCM; however, during the Gulf War it was used as a restrictive measure and as a boundary between the Army and the Air Force. In this conflict the FSCL was employed in other than its doctrinal way, and yet accomplished the maneuver commander's intent; but not without other problems.<sup>52</sup>

The next procedural control involves the synchronization of fast, air assets with artillery fire. This involves coordination of both time and space. These control procedures are found in multiservice doctrine but not joint doctrinal manuals.<sup>53</sup> Separation plans for the employment of both systems include four standard coordination procedures:

Lateral separation,  
Altitude separation,  
Time separation, and  
Altitude and lateral separation.<sup>54</sup>

The last procedural technique is prioritization. The artillery uses three types of priority targets to support the maneuver commander in the close battle: priority targets, Copperhead targets, and final protective fires.<sup>55</sup> These three types emphasize the responsiveness aspect of fire support.

## **TARGET ACQUISITION BATTLEFIELD SURVEILLANCE**

In the FA system, target acquisition and battlefield surveillance are accomplished by a variety of resources. For the close fight, forward observers, fire support officers, aerial observers, scouts, liaison officers, and forces-in-



contact cover the battlefield. Their range is limited by weather conditions, equipment capabilities, and terrain.

In prosecuting the counterfire fight, at the division level, the majority of acquisitions are supplied by two weapons locating radars (WLRs), Q-37, and three countermortar radars (CMR), Q-36, from the DIVARTY TAB. At the corps level, the counterfire fight is conducted through Q-37 WLRs from the corps artillery target acquisition batteries/detachments. The radars are capable in all weather. They are limited by terrain and vegetation. Units-in-contact are an excellent source for counterfire reporting. Their shell reports, when timely, are usually reliable.

Depending upon the nature of the conflict, acquisitions for the interdiction fight can come from human intelligence (HUMINT), such as scout, long range reconnaissance patrols (LRRP), and special operations forces (SOF). Additional sources include electronic intelligence (ELINT), and the tactical exploitation of national capabilities (TENCAP).

### **WEAPONS SYSTEMS**

The third part of the field artillery system is the weapons system. U.S. heavy divisions use two indirect fire weapons platforms: the howitzer and the rocket launcher. Currently, the Army's fleet of 2150 M109 series, armored howitzers is in a state of transition. Portions of the fleet are being modernized from the M109A2/A3, to the improved versions of the M109A4/A5 and the M109A6, Paladin, models.

The Paladin howitzer is the most

technologically advanced cannon system in the US Army. This weapons system uses state-of-the-art components that dramatically improve the system's ability to survive on the battlefield, to deliver responsive, accurate artillery fire at greater ranges, and to improve the systems availability. The responsiveness improvements are the "heart" of the Paladin. They include an on-board position location, navigation, and direction finding system; a ballistic fire-direction computer; and digital and voice communications (SINCGARS). The howitzer adds a new turret with greater ballistic protection, an NBC protection system for the crew, and a redesigned hydraulic system to reduce the risk of fire. The improvements include an improved engine, a more robust suspension system, and automatic diagnostics for the fire control system. These technological advances provide responsive, accurate artillery fire support at greater ranges and, at the same time, avoid enemy counterfire.<sup>56</sup>

The Army authorized objective was 1700 M109A6 howitzers; however, that number has since been reduced to 824. Of the authorized objective, 824 M109A2/A3s are scheduled to be upgraded to Paladins. This year the Congress has mandated that the Army modernize an additional 48. As of the writing of this paper the Congress had not allocated funding for the additional 48 howitzers.<sup>57</sup>

The M109A4/A5 is a two part upgrade. The M109A4 is a product improvement to the M109A2/A3 howitzer that applies a ventilated face piece system (NBC protection), engine and turret upgrades. The M109A5 is an upgrade to the M109A4 which adds a modified armament system (MAS) making it capable of firing the M203 propellant like the Paladin. The M203 extends the range of the M109A5/A6 to 24kms unassisted and 30 kms with rocket assisted HE.<sup>58</sup> The major capability difference between the two models is the computer

capability in the Paladin. The Paladin can compute and automatically lay on the correct deflection and quadrant data to engage the target. The M109A5 must have its firing data computed by a fire direction center and transmitted to it. Under current projections, 1058 howitzers will be upgraded to the M109A5 model. Another 103 howitzers will be upgraded when the Congress allocates funding. This will leave 165 M109A2/A3 models in the howitzer fleet, and a fleet made up of three different models of self-propelled howitzer for the heavy divisions. The current intent is to upgrade the remaining models to the M109A5 configuration when funding is available.

The M109A2/A3 self-propelled (SP) howitzer is the mobile, DS weapon for armored and mechanized divisions and ACRs. It is lightly armored to provide limited crew protection from small arms fire and shell fragments.<sup>59</sup> It has a range of 18.1 kilometers and 24 kilometers for rocket assisted projectiles. It can emplace in approximately one minute, and has a maximum rate of fire of four rounds per minute for the first three minutes. The howitzer's sustained rate of fire is one round per minute. Within a heavy division, each direct support battalion has 24 howitzers.

The Paladin has a 155mm, 39 caliber, cannon with an increased range of 24 kilometers (km) for standard munitions, and 30 km with a rocket assisted projectile.<sup>60</sup> Upon completion of the program all active 155mm SP components in the 10 Division Army will receive Paladin.<sup>61</sup>

The Paladin improvements make possible the adoption of "shoot-and-scoot" tactics that provide a 60 percent increase in howitzer survivability and a

quantum leap in responsiveness. Technically, the Paladin howitzer is a synthesis of several low risk technologies...to improve survivability, responsiveness, reliability, availability, maintainability, and range.<sup>62</sup>

Operations with Paladin howitzers is a step forward in artillery tactics. This evolution in operations increases survivability from counterfire. Howitzer sections can now work in dispersed pairs. It also provides the FSCOORD the flexibility to return to employing artillery using current tactics of platoon and battery firing positions. The field is discovering that the way the FA fights is changing.... The artillery is more mobile. The shoot-and-scoot tactics of MLRS, Paladin and the future Crusader are decreasing the need for prepared position areas.<sup>63</sup> The technological capabilities of the Paladin allow for a pair of howitzers to occupy a position, fire, and move to a new position like a tank does today.

Of the two platforms, rocket and howitzer, the M109 offers the most versatility with ammunition. It can fire a suite of ammunition variations, including: high explosive, white phosphorous, illumination, improved conventional munitions, mines, smoke, and the precision round - Copperhead.<sup>64</sup>

The second system, the multiple launch rocket system (MLRS), is built upon a Bradley-variant platform. The self-propelled loader launcher (SPLL) has the capability of firing rockets and missiles. Currently, it fires dual purpose improved conventional munitions (DPICM) to a range of 30 km, and fires the Army tactical missile system (ATACMS) to 140 - 300 kilometers depending on the block modification.<sup>65</sup>

## **ROLES WITHIN THE BATTLEFIELD STRUCTURE**

### **CLOSE**

According to FM 100-5, only ground forces can dominate the terrain through close operations... Normally it takes close operations on land to gain decisive and lasting battlefield effects.<sup>66</sup> Under the current paradigm the close battle is the current battle, as such it is the primary battle of the direct support artillery and the main emphasis for the committed maneuver force. At the division-level and below, the close battle involves forces in direct contact with the enemy.

Organizationally, the DIVARTY is structured and equipped predominantly for the close battle. With a forward observer in each infantry platoon; a fire support team (FIST) in every infantry and armor company; a fire support element at each headquarters, battalion and above; and six combat observation lazing teams (COLT) in the headquarters battery, the DIVARTY provides the ground gaining arms an extensive acquisition network for engaging targets of opportunity and planning indirect fires. To add further capability to the artillery, all officers and cavalry forces are trained in calling for indirect fires. Additionally, calling for indirect fires is a common soldier task. The network of observers provides depth throughout the battlefield. Delay occurs, however, in placing the call for fire in the fire support channels -- and in servicing or sorting multiple calls according to the force commander's priorities.

Although the unassisted maximum range of the M109A6 is 24 kilometers,

it is limited by its position in relation to the front line of friendly forces and by the type of propellant loaded on the howitzer. According to the Tabular Firing Table for the M109A2/A3 the maximum range using M3A1, green bag propellant is 9.8kms; using M4A2, white bag propellant is 14.7kms; and using M119A1, super-8-white bag propellant is 18.1kms.<sup>67</sup> The larger cannon on the M109A5 and Paladin will extend the range of the howitzer to 12.2 kms for green bag, 18.3 kms for white bag, and as stated, 24 kms for super-8-white bag. Given that howitzer's unit basic load is a mixture of propellant, the range limitation of the Paladin is 12.2-24 kms, which limits the battlespace the division commander is able to dominate with cannon artillery. If the division is fighting in an area with extremely poor weather conditions, the range of the howitzer may be degraded further. Range capabilities must be balanced with the assigned mission of the artillery battalion. Cannon battalions that are in direct support (DS) to a maneuver brigade and reinforcing (R) cannon battalion for the DS battalion are primarily engaged in the close battle for the brigade commander, and will likely not be as responsive for the division commander.

It is apparent that as cannon battalions modernize with the Paladin, and commanders have the opportunity to test its capabilities, they are discovering that the artillery can now move about the battlefield like an armor or infantry formation.<sup>68</sup> The advantages are thought provoking. Colonel R. Stephen Whitcomb, commander of the 2nd Brigade, 24th Infantry Division, summed up the impact of his new Paladin battalion during a quarterly training briefing: "I now have *four* maneuver battalions."<sup>69</sup>

"The enemy is best defeated by fighting him close, deep [and rear] simultaneously. In doing so, Army forces use deep [and rear] operations to set the conditions for decisive future operations."<sup>70</sup> As the division commander's primary combat support force multiplier, the FA is used correctly to achieve the conditions desired for the close fight. When used in conjunction with the divisional aviation brigade, the FA provides the commander with a lethal package.

In order to set the conditions for the corps' close battle, the corps commander uses his corps artillery cannon battalions to weight the division close fight. As a corps artillery weapon, it is used primarily for suppression of enemy air defenses (SEAD) to support aviation operations and limited interdiction fires. Because of the munitions array carried by cannon battalions, and the limited number of rounds carried in its UBL that can achieve the maximum range of 30 km, the cannon battalions are designed and stocked for the close fight. The principal use of corps battalions in the division, however, is as reinforcing artillery to the DIVARTY DS battalions fighting the close fight.

The one MLRS battery in the DIVARTY provides the division commander with a limited deep fires capability. Because the MLRS currently only has one rocket munition, DPICM, it is suited primarily as the premier counterfire weapon of the division. The main limitation for the DIVARTY and the corps artillery, in fighting the counterfire fight, is that the corps and division artillery radar (Q37) assets have the same range. The Q-37 range of 50 km establishes an undesirable situation in which the division commander can acquire and track enemy indirect fire weapon systems that are firing on his formations, but he can

not engage those beyond the range of his firing units without air power. The corps artillery commander has the opposite dilemma. He can fire beyond the range of his radar platforms. The only solution at this time is to use additional acquisition platforms or link the divisional radars corps systems. Unfortunately, other platforms, such as JSTARS, are not as suited for the counterfire fight, as the Q-37. Lastly, the secondary role for the DIVARTY MLRS battery is largely in the role of interdiction fires.

Within the corps artillery, the MLRS battalions are able provide a deep weapons platform for the corps commander through ATACMS fires at high payoff targets.

The commander uses the "decide-detect-deliver-assess" (D<sup>3</sup>A) methodology to best employ his resources to attack the enemy's high payoff targets and neutralize forces located at decisive points. The process turns the maneuver commander's intent into a specific list of targets to be located and engaged. Combined with the intelligence preparation of the battlefield (IPB), and target value analysis (TVA), the D<sup>3</sup>A provides an ability to shape the battle proactively.<sup>71</sup>

From an organizational perspective, the counterfire battle must be well synchronized between the corps artillery and DIVARTYS. While there are differences in acquisition and range capabilities for the munitions on the MLRS, the use of the D<sup>3</sup>A methodology as an integrated artillery system precludes a disjointed counterfire campaign.



## REAR

Rear operations assist in providing freedom of action and continuity of operations, logistics, and battle command. Since rear operations can be the targets of the enemy's deep attack, the field artillery provides force protection through counterfire and limited close support fires.<sup>72</sup>

For the counterfire fight, the artillery minimizes the enemy's ability to engage rear echelon units with indirect fires. The FSCOORD may accomplish this by placing radar Critical Friendly Zones (CFZ) around key facilities in the rear area. The impact of hostile artillery rounds within these zones automatically generate a priority one fire mission in the direct support fire direction center.

Artillery may be required to fire close supporting fires in the rear area in support of a tactical combat force (TCF), or when artillery is committed to weight the rear battle instead of a TCF. In the latter case the artillery unit may be in direct support of the rear area operations center (RAOC), the military police, or a unit in contact.<sup>73</sup>

In the event the artillery is fired in the close support role, control of the fires is critical. Failure to maintain control may devastate the force. The unit must maintain positive control of its fires and establish procedural controls in the form of FSCMs. In the rear area, restrictive measures are placed around critical and cultural areas. The no fire area (NFA), restricted fire area (RFA), and restricted fire line (RFL) are used.

## DEEP BATTLE AND PARADIGM TRANSITION

According to FM 100-5, deep operations take on a supporting role at best, and are normally incapable of defeating the enemy. "Deep operations are defined as those directed against enemy forces and functions beyond the close battle... A well orchestrated deep battle may help [my emphasis] cause the enemy to be defeated outright or may prevent him from achieving his intended objectives."<sup>74</sup> The Corps Deep Operations Tactics, Techniques and Procedures Handbook states that while close operations have primacy, deep operations provide the commander with the ability to seize the initiative from the enemy, disrupt his tempo and force him into a reactionive mode.<sup>75</sup> The deep fight is generally conducted from the coordinated fire line (CFL) in the division zone out to the maximum range of the longest shooting weapons platform. In the Corps, the deep fight extends from the FSCL out to the corps frontal boundary, if one is used, or the boundary of the designated area of operations.

The deep battle allows the accomplishment of several things:

- it strips the enemy's ability to concentrate combat power and attack in depth;
- it creates the opportunity to defeat enemy forces one echelon at a time;
- it influences where and when future fights occur; and
- it gives [friendly units] the ability to fight outnumbered and win.<sup>76</sup>

Recently corps and division headquarters began setting up deep operations coordination cells (DOCC). The DOCC provides for a synergistic effort by several key members of the staff to focus and coordinate limited corps

and division assets. The goal is to delay, disrupt, attrit the enemy to set the conditions for the close fight. The Vth Corps TACSOP designates the following full time members:

Deep Fires Coordinator (DFC),  
Corps Artillery Current Ops OIC,  
Corps Artillery Targeting Officer,  
A<sup>2</sup>C<sup>2</sup> (G3 Air),  
ALO,  
Corps Artillery G2,  
Aviation Regiment S3,  
EW Officer,  
ADE Representative, and  
the FA Intelligence Officer.<sup>77</sup>

The DOCC may have a number of other significant representatives, depending on the mission and their individual responsibilities at the time:

Corps Commander,  
Corps Chief of Staff,  
Corps FSCOORD,  
Corps G2,  
Corps G3,  
Corps Aviation Officer,  
Deputy Corps Aviation Officer,  
Military Intelligence Brigade Commander,  
LRSU Battalion Commander,  
Corps ADA Commander,  
Corps Artillery Chief of Staff or G3,  
Deputy FSCOORD,  
Corps G3 Plans FSE Representative,  
SOF Representative, and  
Artillery LNOs.<sup>78</sup>

It is apparent from the listed representatives that Vth Corps places a great deal of importance on the deep fight. The majority of the members are commanders or staff primary members.

The artillery weapon of choice for the DOCC is the ATACMS. Because of its range and precision, aside from aviation and fixed wing assets, it is the only weapon that can conduct the deep fires fight.

The divisions also employ the same DOCC concept with a smaller staff. The division places as much emphasis on the deep operations to set the conditions for the close fight. At the division-level the artillery weapon of choice is the MLRS. This limits the division commander's deep, indirect fires to 30 km.

While doctrine and force structure are based upon primacy in the close fight, the application of the artillery in the field is toward a shift in primacy to the deep fight. There seems to be a paradox between doctrine and the application of the field artillery on the battlefield. The trend suggests the beginning of the transition to the new paradigm and Force XXI.

## CHAPTER THREE

### FORCE XXI

*'Force XXI will represent a new way of thinking for a new wave of warfare.'*<sup>79</sup>

*General Gordon R. Sullivan  
Chief of Staff, U.S. Army*

As the Cold War ended, many believed a new epoch in warfare began.<sup>80</sup> An epoch that was based on information management and the application of technological capability. The end of the last epoch left the United States' armed forces with a strategy, force structure, and infrastructure no longer appropriate for the new security environment.<sup>81</sup> The Bush administration, with the advice of the Chairman of the Joint Chiefs of Staff, General Colin L. Powell, decided to change the orientation of the military from a threat based force, as it was when opposed to the Soviet Union, to a capabilities based force required for the new strategic security environment.<sup>82</sup> This decision and the demands of the new environment resulted in the reduction of the military force structure and its infrastructure. The change of focus was also effected by a change in the Army's defense paradigm. During the Cold War, the Army was designed to be a forward deployed force. The end of the Cold War brought about a force projection paradigm.

This situation presented the Department of Defense (DOD) with a two-part challenge: first, to determine the right size and structure of U.S. forces to protect and advance American interests in this new era; and second, to manage the reduction and reshaping of American forces so that they remain the most ready and capable military forces in the world.<sup>83</sup>

To meet the DOD challenge within the Army, General Sullivan decided to ensure America's Army remained trained and ready to fight, and prepared to serve the Nation at home and abroad - a strategic force capable of decisive victory into the 21st Century.<sup>84</sup> Recognizing the rapid advance of technological capabilities, General Sullivan realized that the world was entering a new era - the information era. He also realized that, for the Army to stay competitive, it must modernize into the information age.<sup>85</sup> His vision for Force XXI was that the Army would evolve through the development of a synthesis of science and computer technology. The strategic goal for FORCE XXI was to build a force for the 21st Century that was more lethal, survivable, capable of sustained high tempo operations, deployable, versatile and sustainable, and with increased joint and combined connectivity [my emphasis].<sup>86</sup> General Sullivan observed to General Frederick Franks, Commander of the Army's Training and Doctrine Command (TRADOC), that technology now provided the Army the capability to achieve decisive victory with a rapidity unmatched in history.<sup>87</sup>

The challenge was to create a 2010 force, and to ensure a continuous basis for change in the years beyond.<sup>88</sup> General Sullivan's conceptualization was established in a campaign plan. The plan provides both the intellectual construct and the key decision points to achieve Force XXI.<sup>89</sup> It consists of three axes and is divided into three intermediate phases, each culminating with an experimental objective.<sup>90</sup> The axes focus on the operational Army, the institutional Army, and information technologies.<sup>91</sup>

The operational Army was designated as the main effort, and was named

"Joint Venture." Joint Venture is a partnership between all major commands and the Army Staff. The Commander of TRADOC has responsibility for overseeing and coordinating this effort.<sup>92</sup>

The institutional Army, which is that part of the Army that generates and sustains the operating forces, is a supporting effort. Joint Venture is also designated as a collaborative effort between the major commands and the Army staff under the supervision of Vice Chief of Staff of the Army, with the Deputy Chief of Staff for Operations and Plans as the executive agent.<sup>93</sup>

The third axis, also a supporting effort, concentrates on the development and acquisition of information age technologies.<sup>94</sup> To focus the resources and concepts related to the development of this axis of Force XXI across the Army, Secretary of the Army West and General Sullivan formed the Army Digitization Office under the direction of the Vice Chief of Staff of the Army.

Each of the three phases, is aimed primarily at an echelon of the operational Army. Concurrently with each phase, exercises, experiments and demonstrations for the other two echelons will be ongoing. The first phase concentrates on the brigade, the second on the division, and the third on the corps.<sup>95</sup>

The first phase is centered around **Task Force XXI** which is a brigade-sized experimental force in the 2d Armored Division at Fort Hood, Texas.<sup>96</sup> Task Force XXI is composed of a light infantry battalion, a mechanized infantry battalion, an armor battalion, an aviation task force, and a full complement of combat service and combat service support units.<sup>97</sup> The field artillery support for

the task force is centered around a direct support and a reinforcing Paladin battalion. The brigade also has a battery of 105mm towed howitzers to support the light infantry task force.<sup>98</sup> The advanced warfighting experiment (AWE), Focused Dispatch, for this phase is scheduled for 1995. It is the hypothesis of this effort that procedural, functional, and organizational changes in fire support, intelligence, combat service support, and battle command, from the AWE, will result in significant enhancements in lethality, survivability, and tempo.<sup>99</sup>

The second phase focuses on the design of the Force XXI division. The intent is to build upon the lessons learned from phase I. Concurrently with the development of Task Force XXI, the Army's leadership is developing three operational designs for the division of the future:

The current "Army of Excellence" design, modernized with new equipment as it becomes available.

The "Modular Division - Small Base" design, which contains both heavy and light brigades: it beefs up the three ground maneuver brigades of today's division, but reduces the division's air defense and attack aviation assets, and eliminates the main support battalion.

The "Brigade-based division" design in which the division headquarters focuses on the battle command of a variety of brigades assigned to it as the mission requires.<sup>100</sup>

As of the writing of this paper, initial computer modeling and testing for the three options is complete. General William Hartzog, Commander of the Training and Doctrine Command, decided in early December, 1995, that the interim model for the division base would be a variant of the modular division - small base (see



appendix seven). The premise for the division model was posited by Brigadier General Joseph K. Kellogg Jr., Assistant Deputy Chief for Combat Developments at TRADOC. Under this model, the DIVARTY's combat power is increased through the shift from a MLRS battery to a battalion. The interim battalion has 18 MLRS launchers instead of nine under the current force structure. This increase, in the near term, provides the ground gaining commander a 100% increase in launch platforms. In the long term it proved a much higher lethality through addition of developing munitions. The decision by General Hartzog allows the Army to begin the next step in redesigning the division base for the 21st Century.<sup>101</sup>

The third phase is the development of the 21st Century corps. By the time the first two phases are completed, the Army leadership should have a fairly good idea of the issues that must be addressed in the formation of the 21st century corps.

General Sullivan provided an intellectual point of departure for approaching Force XXI for the soldiers, officers and the senior leadership of the Army.

I want us to think about all this in terms of battle command and Battlespace. Battle command is about imposing control on Battlespace, which I think of in terms of the dimensions of speed, space and time - all of which are compressing. That key will be tempo - being able to shut down an opponent in all three dimensions - faster in a physical sense, over greater distance and with greater alacrity in an organizational sense.<sup>102</sup>

He approved five objectives for framing the approach to building the Army

of the 21st century:

Dominate maneuver,  
Protect and sustain,  
Conduct precision strikes,  
Win the information war, and  
Protect the force.<sup>103</sup>

Of the five objectives, "conduct precision strike" applies most directly to the field artillery. The long range fires of the cannon, rocket and missile systems enable the artillery to quickly lift and shift massed fires across a unit's front. With programmed weapons systems and munitions, the artillery has the ability to achieve battlespace dominance. The programs will be addressed later in the paper.

Finally, in order to impose control on Battlespace and sustain the tempo of operations, the Army must be ready. Readiness is the Department of Defense's number one priority even in times of rapid change.<sup>104</sup> As General Sullivan has repeatedly pointed out, while preparing for the future, we must still be ready for today -- "there are no time outs."

### **TECHNOLOGY**

For the long term, the challenge is to provide technologically superior equipment to United States forces in order to improve their chances of success in future conflicts.<sup>105</sup> Secretary West stated the key factor in meeting the challenges of the next decade and beyond: "America's Army relies on a technological edge to overmatch our adversaries. To maintain this edge, we must continue to modernize."<sup>106</sup> Responding to the long term challenge, the Army is continuing to follow the model established by General William E. Depuy, who, as the first

TRADOC Commander, tied doctrine and standards derived from doctrine to combat developments, training and our investment strategy.<sup>107</sup>

The technological edge to which Secretary West referred is a perishable commodity. If it is not continuously managed, the field artillery will not be able to contribute to mission accomplishment -- victory on the battlefield. The senior leadership of the Army has the opportunity to achieve the Bush Administration's intent of creating a capabilities based Army. The reality of that intent is to establish an Army that is equipped with the capability to achieve decisive victory at depth rather than through the close fight.

The technology under development for the field artillery that makes Force XXI possible includes weapon platforms and munitions. In a holistic sense platform, munition, and sensor, function as a system. As Force XXI moves closer, these systems are moving more and more toward what is known as brilliant technologies. They achieve greater range with increased accuracy and greater lethality.<sup>108</sup> The potential for brilliant technology development is tremendous. An example is the synergistic potential derived from combining individual brilliant technologies into an enhanced brilliant weapons system.

The development of the following component technologies of the artillery system are examples of enhancements toward brilliant technologies:

- ATACMS Blocks: IA, II and IIA ;
- The Crusader (the next generation, self-propelled, 155mm howitzer);
- The product improvement of the Multiple-Launch Rocket System (MLRS);
- The bistatic radar for weapons location;
- The Brilliant Anti-armor (BAT) Submunition;

The Sense and Destroy Armor (SADARM)  
Submunition; and  
The Joint precision strike demonstration (JPSD)  
program are the intended component parts of  
systems that will conduct precision strikes.<sup>109</sup>

These systems, employed with all of the elements of the artillery system, bring a synergistic effect to the battlefield that greatly reduces or eliminates the errors of the five elements of accurate predicted fire. In this case, all things being equal, one round may equal one kill at ranges out to and beyond 300 kilometers. Under these conditions, the range of the artillery may soon be limited by the Intermediate Nuclear Forces (INF) Treaty rather than available technology or technological potential.<sup>110</sup>

Looking further down the Force XXI time line, other components are being designed to continue to enhance the capability of the artillery well into Force XXI. They include:

The Command and Control (C<sup>2</sup>) Attack System,  
The High Capacity Projectile (HICAP),  
The Radio Frequency Attack Munition (RFAM),  
The Deep Attack Wide Area Mine (DWAM),  
The Longfog [a precision strike, man-in-the-loop fiber  
optic guided missile with a range of 40km],  
The Adaptive Missile (ADAM),  
The Advanced Tactical Rocket (ATAR),  
The Scorpion [rocket] Launcher (planned as the  
replacement for the MLRS),  
The Future Submunition,  
The Low Cost Competent Munitions,  
The Trajectory Real-Time Analysis Closed Loop  
(TRAC), and  
The Battlefield Imaging Projectile System (BIPS).<sup>111</sup>

These systems provide the ground gaining commander the ability to prosecute his concept of operations at depth rather than using the artillery to set

the conditions to fight the close fight. It will be possible to achieve decisive victory through the deep fight. This is not to presuppose that the land forces will not require force protection, or that there will not be a close battle. The close battle will complete the destruction or annihilation of the enemy's army until he agrees to surrender.

Secretary of Defense, William J. Perry, in his Annual Report to the President and the Congress, recognized the importance of destroying the enemy at depth, especially with a force projection Army. Perry wrote:

The key to halting invading armies in theater warfare is to quickly damage or destroy large numbers of their armored vehicles. New technologies for smart munitions capable of accomplishing this task are maturing rapidly. [For the artillery, these technologies include]... the wide area mine (WAM) and the brilliant anti-armor submunition (BAT). These systems should reduce friendly casualties significantly. Taken together [with other systems also under development], these advanced munitions and sensors will provide U.S. forces with more highly concentrated firepower to blunt an armored invasion in the opening phase of a regional conflict.<sup>112</sup>

The inherent risk, in not recognizing the decision point available through technological capabilities, is that the senior leadership is so ingrained with the current paradigm, built over the last forty plus years, that they will miss the opportunity to maximize the capability of the planned and programmed technologies. The danger of becoming like General Haig during WWI is real.

## **CHAPTER FOUR**

### **THE NEW PARADIGM**

*"Once again the, a paradigm shift is developing. Many of the old rules of land warfare that concern the calculation of combat power have been shattered already. Individually and collectively, the implications of these packages will require significant adjustments in doctrine, leadership, organizations, command and control, as well as service relationships. The limiting factor will not be technological; it will be human and organizational."*<sup>13</sup>

*General Gordon R. Sullivan and Colonel James M. Dubik*

### **TRADOC 525-5**

The Army's attempt to execute the next step of the evolution of land combat has been envisioned by General Sullivan and by TRADOC. The evolutionary process includes transition. The transition involves the movement through Force XXI.

TRADOC's vision of the evolution is conceptualized in the current TRADOC Pamphlet 525-5, Force XXI Operations. "It describes, in general terms, how the Army will function as the primary land force executing joint, multinational operations in War and Operations Other Than War (OOTW) to achieve established objectives in operations where domination of terrain or control of populations is central to victory."<sup>14</sup> Within the realm of war, TRADOC Pam 525-5 envisions the expanded battlefield, alluded to by Dr. Schneider, with the enemy continuously under attack. This is an evolution of the battlefield organization outlined in the 1993 edition of FM 100-5 in which deep, close, and rear operations are merging into a nonlinear, seamless battle. Current Army doctrine states that

"while close operations have primacy, deep operations provide the commander with the ability to seize the initiative from the enemy, disrupt his tempo and force him into a reactionary mode."<sup>115</sup> In TRADOC Pam 525-5, "[The] deep battle has advanced beyond the concept of attacking the enemy's follow-on forces in a sequenced approach to shape the close battle to one of simultaneous attack to stun, then rapidly defeat the enemy."<sup>116</sup> On this future battlefield, "as armies seek to survive, formations will be more dispersed, contributing to the empty battlefield. Commanders will seek to avoid linear actions, close-in combat, stable fronts, and long operational pauses."<sup>117</sup> "This", according to a Department of the Army forecast of future weapons systems, "requires precision deep attacks against threat maneuver formations and his logistical and command lines of communication while simultaneously denying him safe sanctuaries."<sup>118</sup>

The concept of conducting precision strikes is addressed as one of the objectives of Force XXI by Secretary of Army West and General Sullivan in their vision paper on Force XXI.<sup>119</sup> The ability to conduct deep precision strikes is dovetailed with the battle dynamic outlined in TRADOC Pam 525-5 as depth and simultaneous attack.

Depth and simultaneous attack will be a key characteristic of future American military operations. These operations redefine the current ideas of deep, close and rear. The ultimate goal of depth and simultaneous attack is to overload the enemy's ability to cope by presenting an overwhelming number of actions throughout the depth of the battlefield.<sup>120</sup>

Arguably, future technologies will enable military forces to conduct deep precision strikes and defeat the enemy without having to rely primarily on the close

contact battle. This raises the question of whether or not the close fight still retains primacy as outlined in doctrine. TRADOC Pam 525-5 suggests that it may not.<sup>121</sup> Currently, the only force modernization initiatives for the Army, focused only on the ability to conduct deep and simultaneous attacks using precision strikes, are the Apache 'Longbow' helicopter, the Advanced Field Artillery System (AFAS) ['Crusader'], and the Future Armored Resupply Vehicle (FARV). However, all other weapons systems are being improved continually. Ammunition for all these weapons systems is also being developed such as: the Brilliant Anti-Armor Submunition (BAT) and the Sense and Destroy Armor (SADARM).<sup>122</sup>

The development of 'Longbow' and 'Crusader', by the Army leadership, clearly indicates the dominant vision of the future battlefield and the dominance there of long range systems. In this vision, the Field Artillery is at the center of future conflicts. Long recognized as the greatest killer in battle<sup>123</sup>, the field artillery will sustain that role with improved precision guided munitions, enhanced weapons systems, increased ranges, and improved lethality. The advent of new technologies, such as brilliant systems, engenders questions about changes in force structure, command and control, and doctrine.

Currently senior leaders, such as General (retired) Glenn K. Otis, are discussing changes in the future role of field artillery, as the relationship between fire and maneuver once again shifts toward the ascendancy of fires. According to General Otis, "We'll use long-range fires as the spearhead of the attack to the extent that the ground maneuver forces may only need to mop up after the fires."<sup>124</sup> This concept dovetails with General Sullivan's vision of deep precision



strikes, and supports the argument of shifting away from the primacy of the close contact fight. Brigadier General Leo Baxter, Deputy Commandant of the Field Artillery School has stated, that "during this period of transition the Field Artillery will undergo the greatest changes in its history."<sup>125</sup> Fielding new technologies such as the Crusader, enhancement of acquisition platforms, and development of brilliant munitions already allows the Field Artillery to successfully prosecute a conflict at depth, using precision fires, and subsequently, defeat the enemy.

Additionally both generals discuss changes in the concept of force structure. For example, General Otis describes forming an artillery division in which the infantry and armor units serve as protection forces, while the artillery, attack helicopters, and fixed wing airframes destroy enemy forces throughout the depth of the theater. Once the artillery has reduced the enemy to the level desired by the commander, the protection forces will destroy any remnants. In this scenario, the close fight no longer maintains primacy, and moves away from the current notions of support and task organization, toward concepts of supporting and supported. In this case the infantry and armor are supporting forces and the artillery is the supported force.

The new paradigm that is developing is built upon a framework of lethal, long range, precise fires whose delivery means are protected by mobile forces. The endstate is founded, in spirit, under the banner of Force XXI. Under the new paradigm, the sources of fires are the field artillery, Army aviation and fixed-wing airforces. The sources of protection are infantry, armored and air defense formations. This change in roles is not reflected, currently, in the transition to Force XXI in which the close fight is still the primary fight. In the new paradigm, the primary combat will

be that which is now called the deep fight. In the new paradigm it will be called the main fight.

In the main fight, field artillery, Army aviation, and fixed-wing air forces provide the decisive actions to destroy the enemy; however, ground formations must still advance and occupy the enemy's terrain. Fires and aviation assist in establishing the conditions for the ground gaining arms, but cannot seize and hold terrain.

In order to successfully accomplish the evolutionary step to the new paradigm two events must occur. The first event is the development and fielding of the equipment capable of conducting operations under the new paradigm. The second event involves the education of soldiers and leaders. During the first event the equipment to be fielded includes weapons systems, the command and control system, and acquisition systems.

Under the current paradigm the Army is limited in its indirect-fire operations by having three different howitzer models -- M109A2/3, M109A4/5 and M109A6 -- in the field at the same time, range, and the inability to minimize the five elements of accurate predicted fire. During the transition to the new paradigm, the Army will have at least four different models -- M109A2/3, M109A4/5, M109A6 and the Crusader, and will be better able to engage and destroy targets decisively. The MLRS will continue in its role as the premier indirect fire weapon until it is replaced by the Scorpion Rocket Launcher, which is capable of firing the entire suite of MLRS family of munitions and C-130 compatible.<sup>126</sup>

During this period, the command and control system technology is based on the Army battle command system (ABCS). The ABCS is a three tiered concept that

will integrate the information flow across the battlefield. The artillery's initiative is part of the second tier, which is the Army Tactical Command and Control System (ATCCS). The ATCCS is built on a suite of common hardware and software (CHS). Within the ATCCS the five battlefield functional areas are covered: maneuver, fire support, forward area air defense, intelligence, and combat service support. The artillery's next generation computer, the advanced Field Artillery tactical data system (AFATDS) serves the fire support function.<sup>127</sup> In the new paradigm, a common relevant picture attained through information sharing provided from the AFATDS, will change the purpose of the division and corps.

Currently the division's role is to defend against three or more assaulting divisions in the defense and support subordinate brigade operations against enemy battalions and regiments in the offense.<sup>128</sup> The corps role is to synchronize tactical activities including maneuver, fires of their artillery, naval fires, supporting tactical air, and actions of their combat support and combat service support units, and bring together the effects of these separate activities at the decisive time and place. It may fight as part of a larger force, or in a joint task force (JTF).<sup>129</sup> In the new paradigm, the division will take on the role of force protection for the delivery means that are fighting with fires. The corps assumes the responsibility of fighting the main battle with fire delivery platforms. The corps will assume and expand the concept of the deep operations coordination cells (DOCC) that are currently employed at the division and corps level. Although this may seem like a major shift in the role of the division as described under the Force XXI concept, it is the next step in the evolution of land combat under the Force XXI rolling endstate. Before the transition to a

decidedly different land warfare paradigm can succeed, the Army will have to learn to think about combat in an entirely new way.

The second event is the education of the soldiers and leaders to affect the evolution of the military cultural model of the primacy of the maneuver forces as the combat arms of decision, and the need to change to the employment of new paradigm. This education must begin now during the development of the new weapons systems so that the Army is able to take advantage of the capabilities of the systems when they are fielded. General Sullivan has made a significant effort on educating the Army on Force XXI; however, additional steps are needed to complete the shift between Force XXI and the new paradigm. The educational development should be based on a flexible doctrine with a common relevant picture that will allow operations with sensor to shooter linkages, adaptive force packaging as the norm, and the ability to engage targets with first round destructive fires. Additionally, the doctrine should continue to employ the current doctrine of D<sup>3</sup>A.

The force structure required in the new paradigm is modified from the existing force structure. With the main battle fought at extended ranges, the current fire support teams (FIST) will no longer be required. Force protection forces will have the ability, through the ABCS system, to call for close range indirect fires if required. At the division and corps headquarters, the role of the FSCOORD will become the commander's function. The current concepts of the seven inherent responsibilities (see appendix five) will also be modified. The requirement to furnish a FIST will no longer exist. The technological improvements in precision munitions, target location, and computation capabilities correct the inherent error in the five elements of

accurate predicted fire. This will nullify the requirement to conduct of fire planning under the current concept. The ground gaining commander will have the capability to locate, to identify, to engage, and to destroy high payoff targets at will. The architecture of sensor to shooter linkages he establishes will provide immediately responsive fires on a desired target. The synergistic effect of brilliant technology weapons systems -- sensor, shooter, munition -- will enhance the responsiveness and accuracy of the fires in the main fight, regardless of the target location.

Additionally the four missions (direct support, reinforcing, general support reinforcing, and general support) will change. Under the new paradigm, main battle units provide direct/indirect or reinforcing fires. There may be times, however, when indirect fire units will be in direct support of Army aviation or fixed-wing air forces that are engaging targets in the main battle. In conducting these operations the current FSCMs will be integrated with A<sup>2</sup>C<sup>2</sup> measure to ensure force protection, efficiency, effectiveness, and responsiveness. In many cases there will be no need to use procedural FSCMs and graphic control measures, such as phase lines. The only requirement will be for a zone of action or area of operations.

There may also be occasions when protection forces need close indirect fires; however, these should be extremely rare. The continued product improvements in tanks and infantry fighting vehicles will adequately serve for force protection. Eventually there may be a modification to the howitzers that combines the capabilities of the tank with the howitzer. A highly mobile, heavily protected, weapons system that can engage targets in the main battle, but also fire, high muzzle velocity, flat trajectory munitions with first round lethality. This evolution in

equipment capability will require a large shift within the branches of the Army. In essence it will combine the armor branch with the field artillery.

The transition will be completed when the force structure (weapon systems), doctrine, and training for the new paradigm are in place. The initial implementation of the new paradigm, as a significant shift from the traditional concepts on the employment of the infantry and armor formations, will be the more difficult task. It will take at least one generation of soldiers, noncommissioned officers and officers before the concepts are completely internalized. The challenge in the education process of the new paradigm will be changing the mind sets of the noncommissioned officers and officers who have built a career around the current paradigm. This includes the majority of division and corps commanders who are combat arms officers and are used to the primacy of the combat arms branches -- the infantry and the armor. The risk is having senior leaders like General Haig from WWI that fail to see the potential of the new technologies and adhere to old parochialism.

The major obstacle to completing the transition is primarily cultural. The tradition of awards and promotions for valor in the face of the enemy runs counter to shifting to this new set of relationships. The Army rewards its soldiers for valor in the face of the enemy, and not on the number of soldiers killed or enemy equipment destroyed. Counter to the cultural mind set is the current doctrine which is based on achieving victory at least cost to American soldiers.<sup>130</sup> The doctrine and American ethos of applying overwhelming combat power against any enemy in a traditional strategy of annihilation is in line with the capabilities of the new paradigm.

The concept of fighting with primarily with fires and the inherent task

organization potential, are a paradigm shift away from indirect fires setting the conditions for maneuver forces, to fighting and destroying the enemy with artillery systems. The challenge in implementing the paradigm shift starts in recognizing the potential of technological capabilities and implementing them. The start point for this shift must begin in the minds of the senior leadership; otherwise the Army will continue to fight under the current paradigm and risk casualties that are not required from fighting direct-fire battles and engagements that could have been avoided.

## CHAPTER FIVE

### CONCLUSION

*Force XXI is the Army's vision for the future.*<sup>131</sup>

*TRADOC PAM 525-XX*

The methods and capabilities of land combat are making the next step in the evolutionary process. This step is centered around the current deep fight and the role of the field artillery. The potential for this evolutionary step is predicated on maximizing the capabilities of technology. The shift in the ascent of the field artillery has been occurring gradually since the Franco-Prussian War when, J.F.C. Fuller observed, the artillery assumed a predominant role on the battlefield. Since then, Generals Depuy and Sullivan, and others, have recognized the battlefield dominance of the field artillery. By the Gulf War, MLRS crewman nicknamed the MLRS the grid square removal system because of its demonstrated ability.<sup>132</sup> That dominance is enhanced through the capabilities of current technology which allow first round destructive fires on deep targets.

The current paradigm of battle is founded upon the predominance of maneuver forces over the direct fire battle, for which indirect fires serve as force multipliers. This concept has the Army fighting as a combined arms team with the field artillery providing close support, interdiction, and counterfire, across the close, deep, and rear battle areas. As an area weapon, the field artillery community has worked to minimize the errors in the ballistic solution. Improvements in all three



components (fire support command, control, and coordination (C<sup>3</sup>) facilities, target acquisition and battlefield surveillance, and fire support weapons systems) of the artillery system have enabled the field artillery to become a more precise and lethal battlefield player. Technological developments have increased the range of weapons systems from the end of the *gladius* to over hundreds of kilometers and expanded the battlefield from opposing lines of approximately 10 kms in the late 18th Century to over 200,000 square kms during the Gulf War.

After the end of the Cold War, the Army shifted its attention from a threat based, forward deployed force, focused on the Warsaw Pact and Eastern Europe, to a capabilities based force projection force. General Sullivan adroitly and perceptively began the process of shifting the Army's thinking toward a capabilities based Army for the 21st Century. He posited that the correct intellectual approach toward the future, and the view of the reshaped Army, was a dynamic one. One can best think of Force XXI as the "rolling end state" of a developmental continuum that ultimately results in a series of successively refined future brigades, divisions, and corps.<sup>133</sup> The point of decision rests in the mind of the senior leadership. The rolling endstate that General Sullivan alluded to could be the shift from the current paradigm under which the Army fights to the new paradigm.

The new paradigm has evolved beyond the concept of integrating the field artillery as a support arm under a combined arms concept. In the new paradigm, long range fires are not a support arm, but a decisive arm that changes the fire support combat function to a Fires combat function. Two significant events mark the transition to the new paradigm: the fielding the equipment and the inculcation of the

new concepts by the soldiers, NCOs, and officers.

In the new paradigm, artillery, Army aviation and fixed-wing air forces will provide a synergistic effect on the battlefield. While, this monograph has focused on the employment of the artillery, there will be occasions in which the artillery will fire to support aviation operations.

The anticipated shift requires a deliberate institutional effort to adjust the thinking of all professionals, especially the members of the combat arms.

Technology will require that soldiers acknowledge, in time, that the most lethal system on the battlefield must be the predominant system in tactical and operational warfighting -- the King of Battle.

In considering the suggested change in paradigms, other areas will require additional study. These include, but are not limited to, the integration of FSCMs and A<sup>2</sup>C<sup>2</sup> in synchronizing of armed aircraft, cruise missiles, and ATACMs fires; the integration of force protection and fighting the main battle with the division and corps headquarters; the redefined infrastructure of the Army in branches and formations; the revision of the Army education system; and the employment of tactical movement with fighting with fires.

The Army is no longer based on, nor faced with, a symmetrical threat. As such it is time to take the next steps in the evolution of the Army force structure. This means using the available technological capabilities to their fullest potential and shifting the appropriate models accordingly. Failure to make this shift to the new paradigm is likely to result in a fate for American forces similar to that which befell Iraqi Artillerymen when they faced a peer or near peer force in the Gulf War. After

an artillery raid on February 13th, and in all subsequent raids by allied and coalition forces, the Iraqi's artillery failed to respond. They had failed to make technological improvements in their over-the-hill gunnery that had been available for 20 years.<sup>134</sup> They were either dead or too afraid to fire, knowing they would die.

## ENDNOTES

1. John Frederick Charles Fuller, A Military History of the Western World, vol. 3, From the Seven Days Battle, 1862, To the Battle of Leyte Gulf, 1944 (New York: Funk & Wagnalls Company, Inc., 1956), 133.
2. Quoted in Paul H. Herbert, Deciding What has to Be Done: General William E. Depuy and the 1976 Edition of FM 100-5, Operations Combat Studies Institute, Leavenworth Papers, Number 16. (Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1988), 16.
3. James M. Dubik and Gordon R. Sullivan, Envisioning Future Warfare (Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1995), 11 - 12.
4. Headquarters, United States Department of the Army, America's Army of the 21st Century, Force XXI, Meeting the 21st Century Challenge Office of the Chief of Staff, Army, Director, Louisiana Maneuvers Task Force. With a Forward by Gordon R. Sullivan and Togo D. West, Jr. (Washington, DC: US Government Printing Office, January 1995), Foreword.
5. Field Manual 100-5, Operations, (Washington, DC: US Government Printing Office, June 1993), V.
6. Ibid., 2-13.
7. Field Manual 6-20, Fire Support in Combined Arms Operations, (Washington, DC: US Government Printing Office, 1988), 2-11.
8. Ibid., 1-2.
9. Field Manual 100-5, Operations, 2-10.
10. Ibid.
11. Field Manual 6-20, Fire Support in Combined Arms Operations, 1-2.
12. Ibid.
13. Ibid., V.
14. Field Manual 100-5, Operations, 2-2.
15. S. L. A. Marshall, Men against Fire, The Problem of Battle Command in Future War. (Gloucester, Mass.: Peter Smith, 1978), 83-84.

16. Leo J. Baxter, "Field Artillery, Vision 2020." Field Artillery Journal. HQDA PB6-94-5 (November-December 1994): 10.

17. James J. Schneider, "The Theory of the Empty Battlefield." Journal of the Royal United Services Institute for Defense Studies. 3 (September 1987): 37-44; Training Circular Number 25-1, Training Land, (Washington, DC: US Government Printing Office, August, 1978), 10-11.

18. Dubik and Sullivan, Envisioning Future Warfare, 12; The exact area of expansion maybe contentious. Different references site different relative distances covered in the areas of expansion.

Another source is William G. Stewart, "Interaction of Firepower, Mobility, and Dispersion." Military Review XXXIX (March 1960): 28; During the American Civil War, the area occupied by approximately 100,000 men, was an average of 26.8 square miles. By the Meuse-Argonne campaign, during WWI, the area occupied had grown to 140 square miles. During WWII the average area was 1,727 square miles.

19. Schneider, "The Theory of the Empty Battlefield," 37-44.

20. United States Army Command and General Staff College, Fundamentals of Tactical Operations, (Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, February 1994), 2-18.

21. John Frederick Charles Fuller, Memoirs of an Unconventional Soldier (London: Ivan Nicholson and Watson, 1936), 354.

22. Field Manual 100-5, Operations, 2-2; Field Manual 101-5-1, (Final Draft), Operational Terms and Symbols, (Washington, DC: US Government Printing Office, July 1995), 1-15 & 1-16 defines combat, combat support, and combat service support forces:

**combat maneuver forces** as those forces which use fire and movement to engage the enemy with direct fire weapon systems, as distinguished from those forces which engage the enemy with indirect fires or otherwise provide combat support (CS). These elements are primarily infantry, armor, cavalry (air and armored), and aviation.

**combat support forces** as fire support and operational assistance provided to combat elements. They include artillery, air defense artillery, engineer, military police, signal, military intelligence, and chemical.

**combat service support forces** as the assistance provided to sustain combat forces, primarily in the fields of administration and logistics. It includes

administrative services, chaplain services, civil affairs, food services, finance, legal services, maintenance, medical services, supply, transportation, and other logistical services.

23. Ibid., 2-10.

24. Ibid.

25. Ibid., 2-2.

26. Field Manual 71-123, Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion/Task Force, and Company/Team, (Washington, DC: US Government Printing Office, 1992), 7-1.

27. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-1.

28. Field Manual 6-20-30, Fire Support at Corps and Division, (Washington, DC: US Government Printing Office, 1988), 1-3.

29. Field Manual 100-5, Operations, 6-13.

30. Victory in land combat is nested in mission accomplishment for the subordinate units of the Corps. It's the success of the divisions and the subordinate elements of the combined arms teams that build to achieve victory. At the division-level, the outcome of close operations will ultimately determine the success or failure of the division battle, Field Manual 71-100, Division Operations, (Washington, DC: US Government Printing Office, 1990), 1-5. The same is true for corps-level operations. The corps close operations are the current battles and engagements of its subordinate units.... It is the outcome of the corps close operations which will ultimately determine the success or failure of the corps battle, Field Manual 100-15, Corps Operations, (Washington, DC: US Government Printing Office, 1989), 3-0.

31. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-8.

32. Training Circular Number 6-40, Field Artillery Manual Cannon Gunnery, (Washington, DC: US Government Printing Office, 27 December, 1988), 2-1.

33. Boyd L. Dastrup, King of Battle. A Branch History of the U.S. Army's Field Artillery, (Fort Monroe, Virginia: U.S. Army Training and Doctrine Command, 1992), 287.

34. Field Manual 71-123, Tactics and Techniques for Combined Arms Heavy Forces, 7-2.

35. Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, (Washington, DC: US Government Printing Office, 1994), 400. An ARFOR may be a Uni-Service command which is defined as a command comprised of forces of a single service.
36. Presentation given by the author at the United States Army Field Artillery School Target Acquisition Conference, Fort Sill Oklahoma, 1989.
37. Joint Publication 3-09 (Second Draft), Doctrine for Joint Fire Support, (Washington, DC: US Government Printing Office, 10 March, 1995), iii.
38. Ibid., iv.
39. Ibid., I-2.
40. Chairman of the Joint Chiefs of Staff Manual 3500.04, Universal Joint Task List (UJTL), (Washington, DC: US Government Printing Office, May 1995), B-12.
41. Ibid., B-20.
42. Ibid., B-26.
43. A clearly defined, systematic, and positive command and control ensures that the field artillery contributes to the fire support system in a responsive manner and that it is adequate to support the mission. Command and control relationships are established through a process referred to as organization for combat. Field Manual 6-20, Fire Support in Combined Arms Operations, 1-2.
44. Field Manual 101-5-1 (Final Draft), Operational Terms and Symbols, July 1995, 1-67.
45. The FA commander derives his specific fire support responsibilities from the command relationships and tactical missions he is assigned. Clearly defined, systematic, a positive command and control ensures that the FA contributes to the total fire support effort in a responsive manner and that it is adequate to support the mission. Command and control are established through a process referred to as organizing for combat. This two-step process consists of the following:
- A. Establishing a command relationship:
    - a. Organic,
    - b. Assigned,
    - c. Attached, or
    - d. Operational Control [OPCON]

- B. Assignment of tactical missions:
- a. Direct Support (DS)
  - b. Reinforcing (R)
  - c. General Support Reinforcing (GSR)
  - d. General Support (GS)

Field Manual 6-20-2, Tactics, Techniques, and Procedures for Corps Artillery, Division Artillery, and Field Artillery Brigade Headquarters, (Washington, DC: US Government Printing Office, 7 January, 1993), 1-

- 1.
46. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-8.
47. Ibid.
48. Ibid, 2-10.
49. Ibid.
50. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-10.
51. Field Manual 6-20-20, Tactics, Techniques, and Procedures for Fire Support at Battalion Task Force and Below, (Washington, DC: US Government Printing Office, 1991), 1-18, 1-19.
52. Richard Moody Swain, "Lucky War" Third Army in Desert Storm, (Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1994), 228; Ultimately, CENTCOM took over setting of the FSCL and used it as a boundary, assigning all terrain on one side to the ground commanders and all terrain and airspace on the other to the air component commander. In the words of the Third Army deep fires after-action report: "The end result, ironically, was that the high level of success attained on the ground frequently led to a loss of air support, since bombers could no longer execute their mission, and because the mission manager didn't have the necessary lead time to successfully divert the mission to another target...."

The Air Force capabilities, combining J-STARS observation with sophisticated attack tools, would seem likely to have been much more effective. VII Corps was unable to employ Air Force battlefield air interdiction as a blocking force in support of its maneuver units or maintain continuous interdiction with its own aviation brigade (the 11th). Indeed, because of its lack of control over the FSCL, it could not interdict targets within range."

53. A discussion of artillery-air synchronization is found in Fleet Marine Force Manual 6-18, Techniques and Procedures for Fire Support Coordination, 6-14 to 6-19 and Field Manual 6-20-40, Tactics, Techniques, and Procedures



for Fire Support for Brigade Operations (Heavy), A-16 to A-21; Joint Publications 3-0, Doctrine for Joint Operations, and 3-09 (Second Draft). Doctrine for Joint Fire Support do not address the issue.

54. Field Manual 6-20-40, Tactics, Techniques, and Procedures for Fire Support for Brigade Operations (Heavy), 1990. A-17; Also found in Fleet Marine Force Manual 6-18, Techniques and Procedures for Fire Support Coordination, 6-15, 6-17, 18, 19.

55. Field Manual 6-71, Tactics, Techniques, and Procedures for Fire Support for The Combined Arms Commander (Washington, DC: US Government Printing Office, 1994), M-1.

56. United States Army Command and General Staff College, Fundamentals of Tactical Operations, 3-7, 3-8.

57. United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 1 May 1995, 3-2; Aponte, Manny, Assistant TRADOC Systems Manager - Cannon, Directorate of Combat Developments. Interviewed by the Author, 19-20 December 1995, Fort Leavenworth, Kansas. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

58. Ibid.

59. United States Army Command and General Staff College, Fundamentals of Tactical Operations, 3-7, 3-8.

60. United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 1 May 1995, 3-2; China, Argentina, Finland, France, Austria, India, Singapore, South Africa, and Israel have produced towed howitzers of 40 calibers or larger and achieved ranges out to 50 kilometers. While the upgrade to the 39 caliber howitzer increases range, it does not ensure supremacy because of it. Iraq demonstrated during the 1990-91 Gulf War that long range guns are of little value without capable artillery fire control and target acquisition systems. See Ian Kemp, "Towed Artillery, For Rapid Reaction, Might is Light!" Jane's Defence Weekly, 12 (23 September 1995): 21-26.

61. United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 1 May 1995, 3-1.

62. Ibid, 3-2.

63. C. William Rittenhouse, "Army Science Board: Maneuver Art versus FA Science," Field Artillery Journal HQDA PB6-95-4 (September-October 1995): 2.

64. Field Manual 71-123, Tactics and Techniques for Combined Arms Heavy Forces, 7-4; Training Circular Number 6-40, Field Artillery Manual Cannon Gunnery, 1988, 11- 17, 11-18.

The cannon-launched guided projectile (CLGP) M712 (Copperhead) is a high-explosive antitank 155-mm projectile. It [weighs] 137 pounds and is 54 inches long. The nose of the projectile houses a laser seeker in a plastic cone. The body contains fins and wings that deploy in flight and allow the round to maneuver.

The ground surface area in which the round can maneuver is limited. The optimum limit of maneuverability of the Copperhead round is called the footprint. The size of the footprint is determined by the gun-target range but can be affected by cloud height. The ballistic aiming point is the point on the ground where the Copperhead round would impact if it did not maneuver. The ballistic (bal) aiming point is on the gun-target line, usually short of the target location sent by the laser designator operator. The distance that the ballistic aiming point is short of the target location varies and is called the offset correction. This offset distance is used to ensure that the maximum probability of hit occurs at the original target location sent by the observer. The larger the target location error, the lower the probability of hitting the target.

65. United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 1 May 1995, 31, 32, 33.

66. Field Manual 100-5, Operations, 6-14.

67. Headquarters, United States Department of the Army, Firing Tables, FT 155-AM-2, (Washington, DC: US Government Printing Office, 1983), 142, 338, 390.

68. Robert J. Fronzaglia, "The Paladin Battalion at the NTC - A Commander's Perspective." Field Artillery Journal. HQDA PB6-95-4 (September-October 1995): 14.

69. Ibid., 12.

70. Field Manual 100-5, Operations, 6-14.

71. Field Manual 6-20-2, Tactics, Techniques, and Procedures for Corps Artillery, Division Artillery, and Field Artillery Brigade Headquarters, 1993, 5-2.

72. Field Manual 100-5, Operations, 6-15.

73. Field Manual 90-14. Rear Battle. (Washington, DC: US Government Printing Office, 1985), 3-21.
74. Field Manual 100-5, Operations, 6-14.
75. Headquarters, United States Army Training and Doctrine Command, Corps Deep Operations (ATACMS, Aviation and Intelligence Support) Tactics, Techniques and Procedures Handbook. (Washington, DC: US Government Printing Office, 1990), 1-8.
76. Field Standard Operating Procedures (FSOP), Deep operations Annex. (Vth Corps Artillery Headquarters (AETV-AT-GC), April 1995), D-1.
77. Tactical Standard Operating Procedures (TACSOP). (Vth Corps Artillery Headquarters (AETV-AT-GC), Undated), D-12.
78. Ibid., D-13.
79. Gordon R. Sullivan, "Force XXI, A New Force for a New Century," ARMY, 5 (May 1994): 25.
80. Morris J. Boyd, Doctrine and Force XXI --, Leading the Army into the 21st Century, Deputy Chief of Staff for Doctrine, United States Army Training and Doctrine Command, (Prodigy@ Web Browser: Force XXI Campaign Plan (<http://204.7.227.67:1100/...-essay/doc&fxxi.html>)), 1.
81. William J. Perry, Annual Report to the President and the Congress, (Washington, DC: US Government Printing Office, February, 1995), 11; The White House, "National Security Strategy of The United States," (Washington, DC: US Government Printing Office, 1990), 15,29-30.

President Bush identified the changing international security environment with the ending of the cold war in his National Security report to the Congress and the impact on the military instrument of power. In the Strategy he reports:

The elements of our national power - diplomatic and political, and economic and military - remain formidable. Yet, the relative importance of these different instruments of policy will change in changing circumstances. Our most difficult decisions will include not only which military forces or programs to adjust, increase, reduce or eliminate, but also which risks can be ameliorated by means other than military capability - means like negotiations, burden sharing, economic and security assistance, economic leverage, and political leadership.

In a new era, we foresee that our military power will remain an essential underpinning of the global balance, but less prominently and in different ways. We see that the more likely demands for the use of our military forces may not

involve the Soviet Union and may be in the Third World, where new capabilities may be required....

United States military planning in the postwar era has been dominated by the need to deter and be able to defend against overwhelming Warsaw Pact conventional forces in Europe. As this report has described, this heretofore dominant reality is undergoing significant change both through Soviet and other Warsaw Pact unilateral reductions and through negotiated agreements. This prospect is clearly affecting our military planning.

82. The Future of Warfare. Inaugural Annual Conference of The James A. Baker III Institute at Rice University on "C-SPAN", 26 November, 1995. The comments were made by General (Retired) Colin Powell.

83. Perry, Annual Report to the President and the Congress, 11.

84. Headquarters, United States Department of the Army, Louisiana Maneuvers, the First Year, Office of the Chief of Staff, Army, Director, Louisiana Maneuvers Task Force. With a Forward by Gordon R. Sullivan and Togo D. West, Jr., (Washington, DC: US Government Printing Office, March, 1994), 3.

85. Sullivan, "Force XXI, A New Force for a New Century," 26. In identifying the parameters of Force XXI, General Sullivan poses five questions that must be dealt with as the Army creates Force XXI:

- a. Are new forms of maneuver required?
- b. How do we set the conditions for decisive maneuver?
- c. How do we combine combat, combat support, and combat service support to create a flexible, networked, self-tailoring organization?
- d. How do we command information-age forces?
- e. How do we synchronize the operations of fully modernized, digitized forces with other forces – our own, other services and allies?

86. Ibid.; The goal was to create new formations that operate at even greater performance levels in speed, space, and time than before.

Headquarters, United States Department of the Army. America's Army of the 21st Century, 22.

The **Force XXI Strategic Objective** is to transform the force from an Industrial Age Army to a knowledge- and capabilities-based, Power Projection Army capable of land force dominance across the 21st Century military operations, by leveraging information technology to advantage the Army's quality people, and by redesigning the fighting forces and the Army's sustaining bases to better support these forces.

**General Sullivan's intent.** We will use a rolling baseline to focus our efforts, and make all key fielding and support decisions for the operating force and our Title 10 functions by the year 2000. Information-age technology for battle command, battle space, depth and simultaneous attack, early entry, combat service support will underwrite our capabilities to project and sustain force, dominate maneuver, win the information war, conduct precision strikes, and project the force across the continuum of military operations.

**FORCE XXI Mission.** The US Army designs the 21st Century force, beginning now, to achieve related fielding and support decisions by the year 2000 in order to fully field the total Army force that is capable of meeting our Nation's 21st Century challenges...from the foxhole to factory and front to rear.

87. Boyd, Doctrine and Force XXI, 1.

88. William W. Hartzog, On the Road to Force XXI Commanding General, United States Army Training and Doctrine Command. Prodigy@Web Browser: Force XXI Campaign Plan (<http://204.7.227.67:1100/...-essay/roadfxxi.html>), 1.

89. Headquarters, United States Department of the Army. America's Army of the 21st Century, 11.

90. Headquarters, United States Department of the Army. America's Army of the 21st Century, 11; Headquarters, United States Department of the Army, Force XXI Campaign Plan, Office of the Chief of Staff, Army, (Prodigy@Web Browser:Force XXI Campaign Plan (<http://204.7.227.67:1100/f21camp.html>)), 2.

91. David H. Ohle, "The Campaign Plan." Army. 2 (February 1995): 19-20.

The Operational Army. Joint Venture, the main effort, focuses on the redesign of our operational Army - the Army we send to combat. The plan is broken into three sequential elements, while experimenting with all element concurrently. We will begin with the brigade, move to the division and conclude with echelons above division. Lessons gained from these phases will help in formulating changes we need to make in the institutional Army.

The Institutional Army. Redesign of the Institutional Army is a major supporting effort, which is further divided into four complementary efforts to lead us to the institutional design of the 21st-century Army. They are the major commands' reengineering efforts, these results of base realignment and closure decisions, the output of the Roles and Missions Commission, and functional area analyses on major Title 10, U.S. Code, responsibilities. These, combined with the lessons of the General Headquarters Exercises series and Joint Venture efforts, lead to final design and implementation decisions by 2000.

Information Technologies. Putting information technologies, particular digital communications hardware and software, in the hands of the soldiers and organizations throughout the force provides the capability and architecture to leverage information into combat power.

Field Manual 100-1, The Army, (Washington, DC: US Government Printing Office, June, 1994), 14 - 15.

Addresses Title 10 and its connection to the military. The National Security Act of 1947 (as amended), which is now codified in Titles 10 and 32, United States Code, established the current structure for national defense.... Title 10, United States Code, as amended, is also the source from which the broad functions of DOD are derived. As presently set forth in DOD Directive 5100.1, Functions of the Department of Defense and its Major Components, dated 25 September 1987, DOD maintains and employs armed forces to:

Support and defend the Constitution of the United States against all enemies, foreign and domestic.

Ensure, by timely and effective military action, the security of the United States, its territories, and areas vital to its interest.

Uphold and advance the national policies and interests of the United States.

Safeguard the internal security of the United States.

Headquarters, United States Department of the Army, Louisiana Maneuvers the First Year, 13.

Dovetailed with the Campaign Plan, the senior leadership of the Army sought to ensure that the Army's legally specified tasks were reviewed as part of the Force XXI process. The first objective of the 1993 Louisiana Maneuvers was to determine the issues to be examined. Initially about 200 issues and questions were identified for consideration.... The General Officer Working (GOWG) met to narrow and refine these issues. Of the 200 issues considered, 20 were presented to the Board of Directors (BoD)... The BoD reviewed, modified, and approved warfighting and Title 10 issues for examination in the Louisiana Maneuvers process. The warfighting issues were: HQ above Corps/JTF, Military operations with unfamiliar forces, Owning the night, Battle Command, and C<sup>4</sup>I. The Title 10, U.S. Code issues were: Force Structure, Equipping the force, Mobilization/deployment, and Sustainment.

92. Headquarters, United States Department of the Army, America's Army of the 21st Century, 11.

93. Ibid.

94. Ibid.

95. Ibid., 12. The exercises, experiments, and demonstrations consist of Advanced Warfighting Experiments (AWE), Advanced Technology Demonstration (ATD), Advanced Concept Technology Demonstration (ACTD), and Advanced Concept Technology II Program (ACT II).

AWEs - are center-of-gravity culminating efforts focused on a major increase to warfighting capability. They cross many or all of the TRADOC domains of doctrine, training, leader development, organizations, matériel, and soldiers (DTLOMS). Moreover, they have an impact on most, if not all, of the battlefield dynamics and battlefield operating systems are approved and prioritized by the CG, TRADOC. There is extensive involvement by HQDA, FORSCOM, AMC, and OPTEC.

ATDs - are a Science and Technology funded, risk-reducing, proof of principle demonstration conducted in an operational environment rather than a laboratory. Technology developers, systems managers, and Army users develop exit criteria that allows successful technology to transition directly into system improvements or become part of the Army Research and Development programs. The performance period is intended to be 3-5 years. The objective is to evaluate performance to meet exit criteria.

ACTDs - are a mechanism for intense user involvement in technology assessment and insertion into warfighting systems. Performance period may be multi-phased and extend beyond 5 years. The objective is to evaluate military utility; develop corresponding concepts and doctrine; residual operational capability.

ACTs II - Are technology programs designed to demonstrate proof of principle, high-risk/high-return concepts proposed by industry and academia to support Battle Lab experiments and AWEs. Successful technology can transition directly to end items or become part of Army Research and Development programs. The performance period is intended to be 12 months or less. The objective is to encourage application of new technology not currently available in Army programs.

Hartzog, On the Road to Force XXI, 2. AWEs - small and large are the keys to Joint Venture success. In March, 1995, the Army established the EXFOR, 2d Armored Division...for major warfighting experiments.... Five AWEs are fundamental to the Joint Venture Campaign Plan and will be key in helping us understand how we design future units: ATLANTIC RESOLVE, The Theater Missile Defense experiment, the Mobile Strike Force (MSF) experiment in



PRAIRIE WARRIOR, FOCUSED DISPATCH, and WARRIOR FOCUS.

Perry, Annual Report to the President and the Congress, 110. Eight ACTDs have presently been approved with funding provided by Congress.

Rapid Force Projection Initiative-Enhanced Fiber  
Optic Guided Missile.  
High Altitude Endurance Unmanned Air Vehicle.  
Precision Signals Targeting.  
Synthetic Theater of War-97 (STOW).  
Precision Strike Counter Multiple Launch Rockets.  
Medium-Altitude Endurance Unmanned Aerial Vehicle.  
Joint Countermine.

In a period where the global proliferation of advanced technologies is unprecedented and the generational life of any technological system may be measured in months rather than years or perhaps decades, the ACTD approach provides a means of rapidly moving new capabilities into operational forces. In order to do this effectively, it is critical to closely integrate the warfighter into all aspects of the technology transition process. The ultimate goal of the ACTD is to facilitate the rapid transition of emerging technologies from the laboratory into the field at substantially reduced cost compared to the past and in a manner which provides U.S. forces with timely capabilities to operate safely and effectively in a dynamic global environment.

96. Gordon R. Sullivan, Force XXI--America's 21st Century Army, (Prodigy@Web Browser: Force XXI America's 21st Army (<http://204.7.227.67:1100/.../jv-essay/fxxi3.html>), June, 1995), 2.

97. Headquarters, United States Department of the Army. America's Army of the 21st Century, 25.

98. Wayne M. Chusano, Action Officer for the Task Force AWE, "Field Artillery support in the Task Force XXI," 4 December 1995, Fort Sill, OK. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

99. Headquarters, United States Department of the Army. America's Army of the 21st Century, 25.

100. Sean D. Naylor, "Three Options for Four Stars," Army Times, 16 October 1995, 12.

101. Jeffrey Springman, Scenario Team Chief, TRADOC Analysis Center (TRAC), Scenario Wargaming Center. "Division Design Analysis." Interview by



Author, 28 September through 12 December 1995, Fort Leavenworth, Kansas. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

102. Sullivan, "Force XXI, A New Force for a New Century," 26.
103. Headquarters, United States Department of the Army. America's Army of the 21st Century, 23.
104. Perry, Annual Report to the President and the Congress, 37.
105. Ibid., 43.
106. Leon E. Salomon, "Army Matériel Command: Providing the Technological Edge," Army, 2 (February 1995): 26.
107. Sullivan, Force XXI—America's 21st Century Army, 1; For a good review of General Depuy's work in shaping the Army's training methodology after WWII see Herbert, Deciding What has to Be Done, 1988.
108. Smart technology includes sensor or sensors that can identify a target for engagement, but not know what the identified target is. For example, a SADARM will engage an armored vehicle, but not know whether or not it is a tank or a howitzer. A brilliant technology includes multiple sensors that acquire desired target sets independently, then discriminate a specific target within the target set, ensures that other munitions or systems are not seeking or engaging the target, and destroys it. An example is a follow on to BAT or higher quality technology munition that, once launched, seeks, identifies, and destroys the commander's tank amongst a mixed vehicle moving formation.
109. "Army Weaponry and Equipment," Army, 10 (October 1995): 240, 290 - 296.
110. U.S.N.I. Military Database. Missiles/Rockets - Land Attack/Theater - ATACMS, Provided by the United Communications Group and The U.S. Naval Institute, Edition 05/01/95, (Copyright 1991 by United Communications Group, 11300 Rockville Pike, Suite 1100, Rockville, Md.); The INF Treaty lower limit is 270 nautical miles (311 miles or 500 kilometers).
111. United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 1 May 1995, 64-1 to 64-5.
112. Perry, Annual Report to the President and the Congress, 33, 34;

The WAM, which is still in development, is highly effective in disabling

armored vehicles and allows large areas to be sown with smart mines that should be difficult to neutralize. The WAM is based on the same design as the sensor fused weapon (SFW) which is a dispenser-delivered, wide-area, all-weather munition that gives aircraft the capability to disable or destroy multiple armored vehicles in a single pass. The WAM can be emplaced by either aircraft or missiles. Limited stock of the WAM should be available in FY 1998.

The BAT, also under development, will be delivered by the ATACMS. It promises to be even more effective than the SFW. The Army is also developing the Sense and Destroy Armor (SADARM) submunition, which can be fired by 155mm howitzers. See appendix six for more information.

Although Secretary Perry specifically addresses the WAM and the BAT, The Directorate of Combat Developments at Fort Sill is managing the development of an array of smart and brilliant munitions that will increase the lethality and range of the field artillery on the battlefield. For further information on the munitions and their capabilities see the Program and Project Summary Sheets, published by the United States Army Field Artillery Center and School, Directorate of Combat Developments. The sheets are published quarterly.

Barbara Starr, "Arsenal Ship offers a warfighting Revolution." Jane's Defence Weekly. 12 (23 September 1995): 6; From a joint perspective the Navy is also working to employ the ATACMS from aboard ships. In the same concept of Force XXI the Navy is considering building an "arsenal ship" to conduct surface fire support, strike and surface-to-air missions....Admiral Alexander Krekich, director of surface warfare, is developing the initial concept of operations....Adm Krekich envisions the ship ... firing... navalized ATACMS. Adm Krekich emphasized that the arsenal ship would be a "first day of the war" weapon to perform sustained heavy rates of fire.

113. Dubik and Sullivan, Envisioning Future Warfare, 20.

114. Training and Doctrine Command Pamphlet 525-5, Force XXI Operations. (Washington, DC: US Government Printing Office, 1994), i.

115. Training and Doctrine Command, Corps Deep Operations (ATACMS, Aviation and Intelligence Support) Tactics, Techniques and Procedures Handbook, 1-8; According to the Field Manual 100-5, Operations, p. 6-14, deep operations take on a supporting role at best, and are incapable of defeating the enemy. Primacy still remains with close operations. Deep operations are those directed against enemy forces and functions beyond the close battle... A well orchestrated deep battle may help [my emphasis added] cause the enemy to be defeated outright or may cause him from achieving his intended objectives. Forces in immediate contact with the enemy, in the offense or defense, are fighting close operations.... Only ground forces can dominate the terrain through close operations.... Normally it

takes close operations on land to gain decisive and lasting battlefield effects.

116. Training and Doctrine Command Pamphlet 525-5, Force XXI Operations, 2-9.

117. Ibid.

118. Headquarters, United States Department of the Army, Weapons Systems. (Washington, DC: US Government Printing Office, 1995), 132.

119. Headquarters, United States Department of the Army, America's Army of the 21st Century, 22.

120. Training and Doctrine Command Pamphlet 525-5, Force XXI Operations, 3-11.

121. Ibid., 2-9. The pamphlet addresses the interaction between fire and maneuver, and the shift that may occur. "The relationship between fire and maneuver may undergo a transformation as armies with high technology place increasing emphasis on simultaneous strikes throughout the battle space, maneuver forces may be physically massed for shorter periods of time."

122. Perry, Annual Report to the President and the Congress, 176 - 178.

123. Chris Bellamy, Red God of War, Soviet Artillery and Rocket Forces, (New York: Brassey's Defence Publishers, 1986), 1. "Artillery kills. On major battlefields this century, more than any other weapon;" Glenn K. Otis, "Ascendancy of Fires, The Evolution of the Combined Arms Team." Interview by the staff. (The Field Artillery Journal, HQDA PB6-95-3 June 1995): 19. "A message I've been sending for the past 30 years - that is, in all of modern warfare, the biggest killer on the battlefield has always been the artillery."

124. Otis, "Ascendancy of Fires." 19. General Otis addresses two reasons why he believes there is an ascendancy of fires. First, that we have superior capability to locate the enemy forces with precision. The second is that we have now and are further developing artillery, precision munitions and associated systems to such an extent that we can devote more of our battlefield efforts to raining -- highly accurate -- volumes of fire on the enemy.

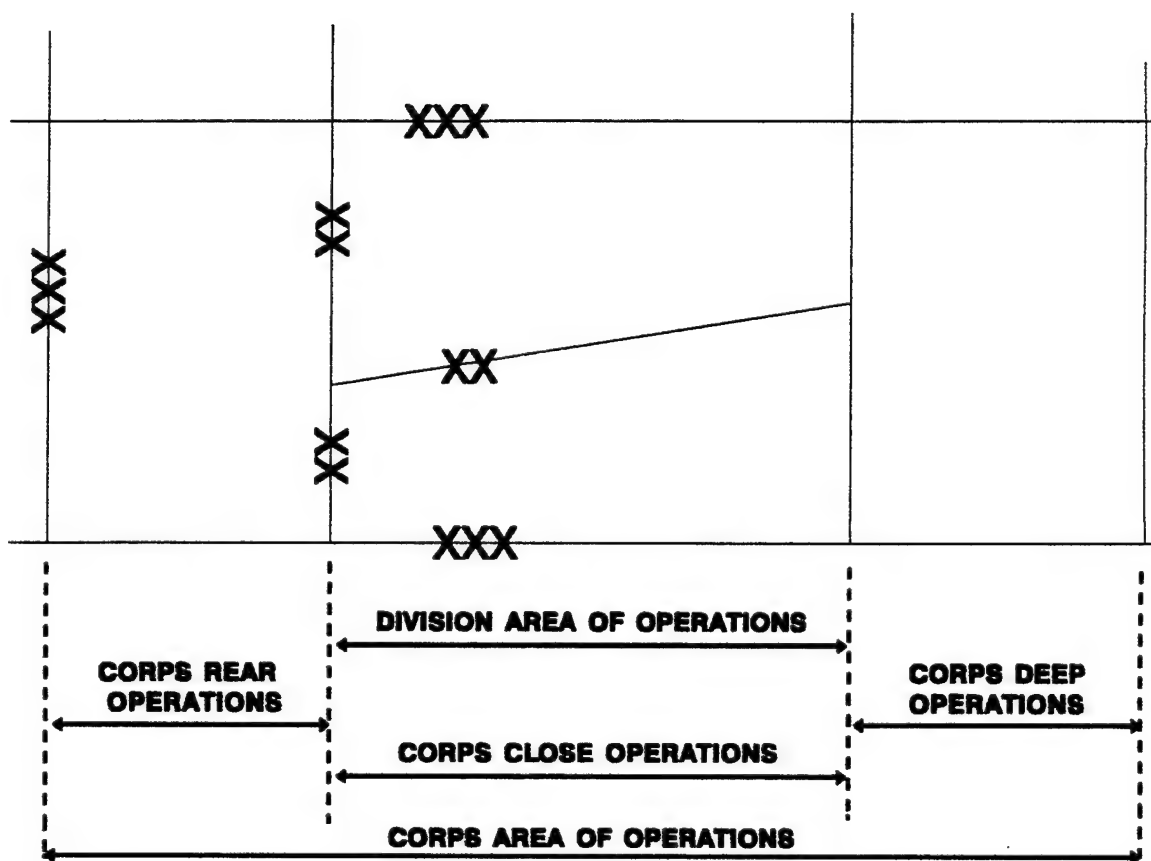
125. Leo Baxter, Field Artillery for Force XXI. (Speech given to the Field Artillerymen of the United States Army Command and General Staff College Class of 1995. Fort Leavenworth, Kansas, 1994), 10.

126. United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 64-4.

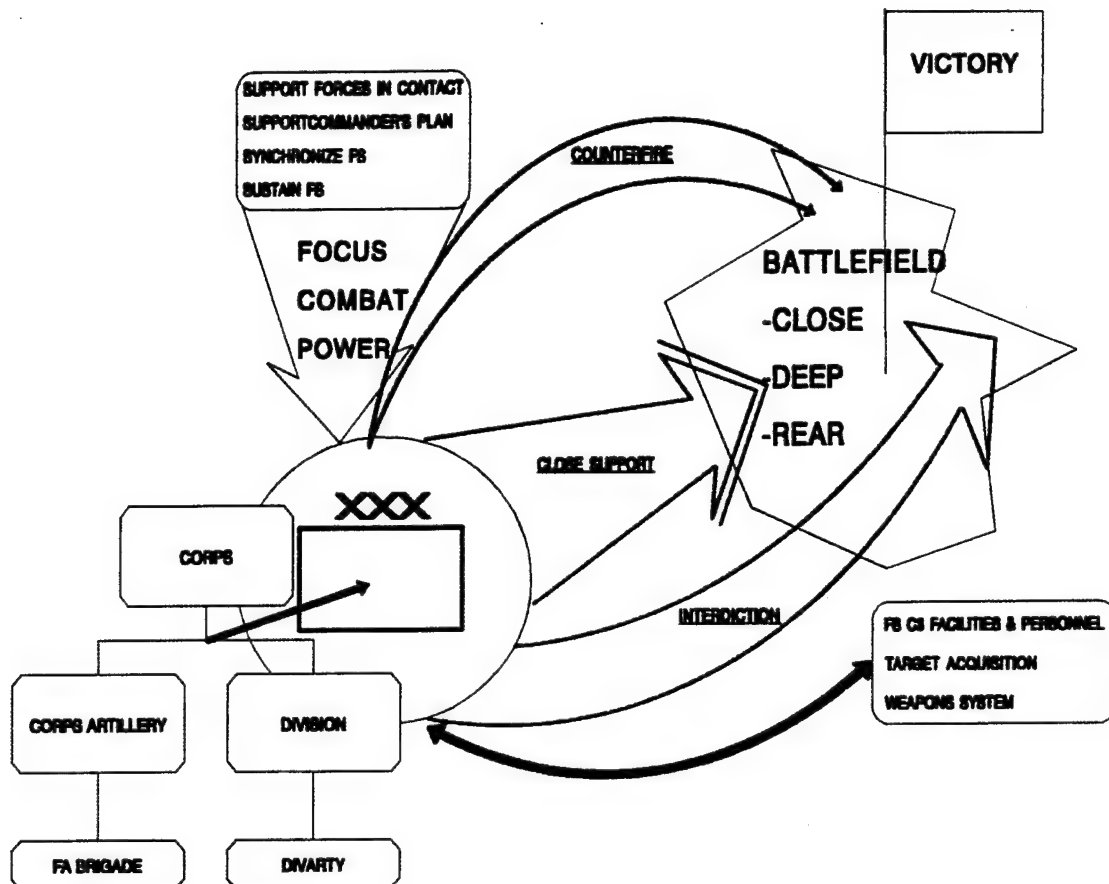
127. Earl D. Noble and Kurt A. Meisenzahl, "AFATDS, The FA's Doorway to the Digital Battlefield," Field Artillery Journal. HQDA PB6-95-4 (September-October 1995): 36 - 37.
128. Field Manual 71-100, Division Operations, 1-1.
129. Field Manual 100-15, Corps Operations, 1-0, 1-1.
130. Field Manual 100-5, Operations, v.
131. Training and Doctrine Command Pamphlet 525-XX, Force XXI Division Operations Concept (Washington, DC: US Government Printing Office, 19 May 1995), Forward.
132. Robert H. Scales, Jr., Terry L. Johnson, and Thomas P. Odom, Certain Victory: The US Army in the Gulf War. (Office of the Chief of Staff, United States Army. Washington, DC: US Government Printing Office, 1993; a selected reprint, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1994), 203.
133. Headquarters, United States Department of the Army, America's Army of the 21st Century, 29.
134. Scales, Certain Victory, 203.
135. Field Manual 100-15, Corps Operations, 3-1.
136. Presentation given by the author at the United States Army Field Artillery School Target Acquisition Conference, Fort Sill Oklahoma, 1989.
137. Field Manual 71-100, Division Operations, 2-2.
138. Presentation given by the author at the United States Army Field Artillery School Target Acquisition Conference, Fort Sill Oklahoma, 1989.
139. Field Manual 100-15, Corps Operations, 2-5.
140. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-11.
141. Ibid., 2-9.
142. The material for this appendix was collated and quoted from U.S.N.I. Military Database, Missiles/Rockets - Land Attack/Theater - ATACMS, Edition 05/01/95, and United States Army Field Artillery Center and School, Directorate of Combat Developments, Program and Project Summary Sheets, 31-1, 31-2, 32-1, 32-2, 33-1, 33-2.

- 143. Field Manual 101-5-1 (Final Draft), Operational Terms and Symbols, July 1995, 1-67.
- 144. Field Manual 100-5, Operations, 2-7.
- 145. Ibid., 6-14.
- 146. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-8.
- 147. Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, 71.
- 148. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-8.
- 149. Ibid.
- 150. Joint Publication 3-09 (Second Draft), Doctrine for Joint Fire Support, GL-7.
- 151. Field Manual 6-20, Fire Support in Combined Arms Operations, 2-8.
- 152. Field Manual 101-5-1 (Final Draft). Operational Terms and Symbols, July 1995, 1-122.
- 153. Joint Publication 3-09 (Second Draft), Doctrine for Joint Fire Support, GL-6.
- 154. Training and Doctrine Command Pamphlet 525-XX, Force XXI Division Operations Concept, B-1.
- 155. B-GL-306-003/FP-001, Field Artillery. Duties of the Battery Commander and the Observer, Volume 3, (FMC HQ/SSO Artillery, 1989), 4-1-3.
- 156. Joint Publication 3-09 (Second Draft), Doctrine for Joint Fire Support, V-8.
- 157. Field Manual 6-20-40, Tactics, Techniques, and Procedures for Fire Support for Brigade Operations (Heavy), 2-18.
- 158. Joint Publication 3-0, Doctrine for Joint Operations, GL-8.
- 159. Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, 145.
- 160. Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, 226; Field Manual 100-5, Operations, 2-13.

161. Joint Publication 3-0, Doctrine for Joint Operations, IV-11, IV-12.
162. Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, 368.
163. Ibid.
164. Ibid.

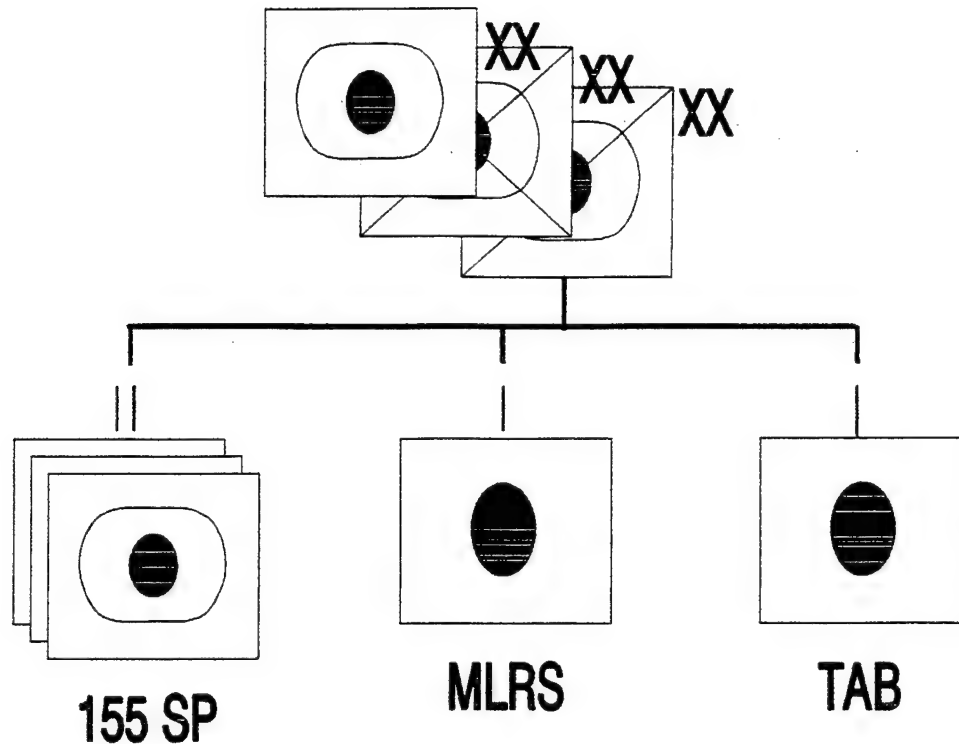


## Appendix 02, The Field Artillery System





### Appendix 03, The Heavy Division Artillery Structure

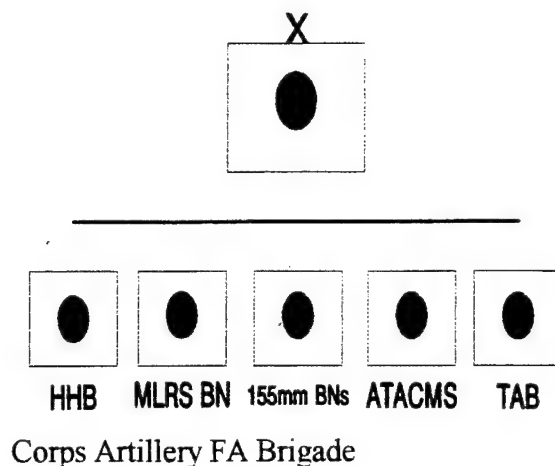


The heavy divisions' artilleries are built around a fixed structure.<sup>136</sup> The DIVARTY, a brigade sized element, has three 155mm, self-propelled (SP), cannon battalions that provide direct support fires to each committed maneuver brigade; a multiple launch rocket system (MLRS) battery that provides general support fires and counterfire to the division, and a target acquisition battery (TAB) that provides target acquisition and electronic battlefield surveillance against enemy indirect fire systems.

The divisional artillery (DIVARTY) is the division's primary organic indirect fire support....The division artillery has the dual mission of integrating all fire support available to the division as well as providing field artillery fires for close support, interdiction, and counterfire support to the division. The primary function of fire support units is to provide continuous and timely support to

combat units by locating, identifying, and neutralizing those targets most likely to impede the successful accomplishment of the division's mission.<sup>137</sup>

## Appendix 04, The Corps Artillery



The corps artillery has no fixed structure.<sup>138</sup>

It contains all of the field artillery cannon, guided missile, and multiple rocket battalions that are not organic to maneuver units. Corps artillery may also contain target acquisition units such as artillery locating radars.... The cannon artillery, rocket, and missile battalions are normally organized into field artillery brigades [which have no fixed structure and] are allocated as needed to augment the fires of committed maneuver units or kept under corps control to provide general support fires. Artillery kept at corps control is used to add depth to the battle, to support rear operations, and to influence the battle at critical times.<sup>139</sup>

An FA brigade is organized with a variety of corps FA battalions depending on the factors of METT-T. The brigade headquarters can control up to six battalions of field artillery. Organization of the brigade and missions assigned may provide for centralized control of fires immediately responsive to the corps commander or decentralized control with brigade fires immediately responsive to a particular corps maneuver force.<sup>140</sup>

## Appendix 05, Inherent Responsibilities of Field Artillery Missions<sup>141</sup>

<u>An Fa Unit With a Mission of—</u>	<u>Direct Support</u>	<u>Reinforcing</u>	<u>General Support Reinforcing</u>	<u>General Support</u>
<b>1. Answers calls for fire from—</b>	1. Supported Unit 2. Own Observers <sup>1</sup> 3. Force FA HQ	1. Reinforced FA 2. Own Observers <sup>1</sup> 3. Force FA HQ	1. Force FA HQ 2. Reinforced Unit 3. Own Observers <sup>1</sup>	1. Force FA HQ 2. Own Observers <sup>1</sup>
<b>2. Has as its zone of fire—</b>	Zone of action of supported unit	Zone of action of supported unit	Zone of action of supported unit to include zone of fire of reinforced FA unit.	Zone of action of supported unit
<b>3. Furnishes fire support team (FIST/FS)<sup>2</sup></b>	Provides temporary replacements for casualty losses as required	No requirement	No requirement	No requirement
	No requirement	To reinforced unit HQ	To reinforced unit HQ	No requirement
<b>4. Furnishes liaison officer—</b>	Company FSOs, FSOs, and supported maneuver unit HQ	Reinforced FA unit HQ	Reinforced FA unit HQ	No requirement
<b>5. Establishes communicatio ns with—</b>	DS FA unit commander or as ordered by Force FA HQ	Reinforced FA unit or as ordered by force FA HQ	Force FA HQ or reinforced FA unit if approved by force FA HQ	Force FA HQ
<b>6. Is positioned by—</b>	Develops own fire plans	Reinforced FA unit HQ	Force FA HQ	Force FA HQ
<b>7. Has its fires planned by—</b>				

<sup>1</sup>Includes all target acquisition means not deployed with supported unit (radar, aerial observers, survey parties, etc.).

<sup>2</sup>A fire support section (FSS) for each maneuver brigade/battalion/cavalry squadron and one FIST with each maneuver company/ground cavalry troop are trained and deployed by the FA unit authorized these assets by TOE. After deployment, FISTs and FSSs remain with the supported maneuver unit throughout the conflict.

## **Appendix 06, MLRS - ATACMS FAMILY OF Munitions**

### **Multiple Launch Rocket System**

Sense and Destroy Armor (SADARM) Sub-munition is intended for both MLRS and M109 155-mm self-propelled gun ammunition. The warhead seeks enemy targets with dual-mode (Infrared (IR) and millimeter-wave radar) sensor, and attacks from above with a self-forging, kinetic energy penetrator.

In October 1993, results from SADARM testing delayed the project for an additional 27 months due to technological problems including: electrical converter failure; vortex parachute failure; and submunition collision following ejection. LRIP (Low-rate initial production (MRLS version) is scheduled for 1997. LRIP for the 155-mm (M109) variant is scheduled for 1996-1997.

MLRS Smart Tactical Rocket (MSTAR) will be a tactical rocket with a robust warhead carrying smart, general purpose submunitions which are effective against a wide variety of high-value targets to include counterfire, air defense, and maneuver. Each submunition will be capable of maneuvering over a large area footprint to independently detect, acquire, and destroy critical targets. The rocket will be fired from the MLRS M270 launcher and/or the High Mobility Artillery Rocket System (HIMARS) launcher. The munition will be deployed within the ammunition loads of corps MLRS battalions and divisional MLRS batteries to provide commanders with a smart munition capability to defeat critical high-value targets at tactical depth. MSTAR will be effective against active or passive, soft or armored, moving or stationary, precisely or inaccurately located targets. MSTAR will offer significantly greater lethality over current rockets while reducing

logistical burdens, minimizing the effects of large target location errors, providing an improved capability to defeat fleeting targets, and reducing collateral damage.

The four planned submunitions include:

- LOCAAS-LADAR
- Damocles
- BAT(P3I)
- SADARM (P3I)

### Army Tactical Missile System (ATACMS).

The US Army Tactical Missile System (ATACMS) is a long-range tactical missile for deployment in modified M270 Armored Vehicle-Multiple Rocket Launcher (AVMRL) which are already used for the Multiple-Launch Rocket System (MLRS). The MLRS AVMRL is modified by changing the pods from two 6-round to two M39 Missile/Launch Pod Assemblies (M/LPA) single-round units and updating the fire-control software to Version 6. The Improved Stabilization Reference Platform (ISRP) provides more precise pointing, the Program Interface Module (PIM) allows the launcher and the missile to exchange more data, and the Improved Electronics Unit (IEU) gives better flexibility for processing types of munitions.

ATACMS is a semi-ballistic missile, with inertial guidance provided by a Honeywell H700-3A ring laser gyroscope system. Launch can be as much as 30 deg off-axis and the missile is steered aerodynamically by electrically actuated control fins during the descent, modifying the flight path from a ballistic parabola. Offsetting the launch angle and descending semi-ballistically mode complicates enemy trajectory plotting to find the launch vehicle. Its disadvantage is that

accuracy is less precise than a straightforward flight path would achieve.

The missile was deployed with an M74 warhead that dispenses 950 M42 Anti-Personnel/Anti-Material (APAM) submunitions that are cast forward at a 45 degree angle over the target area. According to Army magazine (Jan 1992), the result is coverage of a "footprint" some 600 ft (183 m) square. Discounting the 4% of bomblets that may not explode, then figuring each submunition as dispersing of 1,200 splinters out to a 49-ft (15-m) lethal radius, 18 ATACMS would have the effect of 792 155-mm artillery rounds. Another, unofficial estimate is that four to six ATACMS, properly employed, could destroy a tank battalion.

### CHARACTERISTICS

Weight with Block 1 warhead 3,687 lb (1,672 kg)

Dimensions:

length: 13 ft (3.96 m)

diameter: 24 in (610 mm)

Propulsion: Atlantic Research 40,000-lb (18,144-kg)

static thrust solid-propellant rocket

Performance: Maximum range 81 nm (93.2 mi;  
150 km)

Warhead: M74 containing approx 950 M42 bomblets

### VARIANTS

Assault Breaker Technology demonstration program begun by the Defense Advanced Research Projects Agency (DARPA) in 1978. Martin Marietta T-16 (based on Patriot) and LTV T-22 (based on Lance) participated in 15-flight demonstrations in spring 1981. This inspired the Army's Corps Support Weapons System (CSWS) and Air Force's Conventional Standoff Weapon (CSW). Two



programs combined in 1982, but the Air Force dropped out in November 1984.

[This] led to ATACMS on MLRS program.

High Mobility Artillery Rocket System (HIMARS) . This system consists of a six-pack of MLRS rockets mounted on an C-130 transportable FMTV five-ton chassis. Launcher evaluation tests were conducted on 13 December 1993 when a single MLRS rocket was fired from the test launcher. In March 1994, an ATACMS missile will be launched from HIMARS. HIMARS uses an electronics package identical to that of the MLRS M270 launcher and is compatible with all MLRS munitions. As of 1994, the US Army plans to equip three battalions with HIMARS.

#### ER-ATACMS (Extended Range ATACMS)

Block IA is a conventional munition designed to attack targets to 300 km. It is a semi-ballistic missile with an anti-personnel anti-materiel (APAM) warhead that contains 300 bomblets. It is designed to defeat soft fairly stationary targets such as air defense artillery sites, surface-to-surface missile sites, command and control complexes and logistic sites. The missile has a global positioning system augmentation (GPS) to the inertial navigation system. Production is planned to begin on the Block IA in FY95 with units becoming operational by 1996, and completed by 1998.

Block II is a semi-ballistic missile designed to attack targets at ranges up to 140 km. It delivers 13 brilliant anti-armor submunitions (BAT) to their dispense point over the target area. The BAT is discussed later in this appendix.

Block II A is a semi-ballistic missile designed to attack targets at ranges up to 248 km. The missile delivers 6 improved BATs to their dispense point over the target area. The improved BAT (preplanned product improvement (P3I) is discussed later in this appendix).

Brilliant Anti-Tank submunition (BAT). First revealed in June 1991. Classified development effort begun in 1984 to develop a "brilliant" weapon that autonomously seeks and destroys armored vehicles when deployed from ATACMS or AGM-/MGM-137 Tri-Service Standoff Attack Missile (TSSAM). Offers the considerable advantage of breaking up armored formations from great range without requiring any command or data link.

The BAT is a dual mode (acoustic and infrared) submunition that automatically seeks out and kills moving armored vehicles, and surface-to-surface missile (SSM) transporter-erector-launchers (TELs). Once dispensed, the submunitions will kill armored vehicles by attack from the top.

The Preplanned Product Improvement (P3I) BAT is a dual mode (acoustic and dual mode infrared and millimeter wave) submunition that autonomously seeks out and kills stationary and moving SSM TELs. The BAT P3I will also attack moving and stationary armor. The delivery missile will carry the submunitions to the target area and dispense them. Once dispensed, the submunitions will also kill armored vehicles by attack from the top. The BAT uses the acoustic probes for initial detection and classification. The probes are carried at the tips of four mid-body wings which are arranged in cruciform layout. An infrared (IR) sensor in nose is used for terminal homing on the target from above.

The BAT Also has improved warhead lethality, countermeasure resistance, and improved adverse weather performance. The warhead is a tandem shaped charge.

#### BAT Characteristics

Weight 44 lb (20 kg)

Dimensions:

length 36 in (0.914 m),

fuselage diameter 5.5 in (140 mm).

In addition to mid-body wings, 4 curved stabilizers extend at the rear of the body.

Successfully completed first of 21 flight tests on 25 June 1993. These tests evaluated guidance, computer and control systems. BAT was dropped from an aircraft at 10,000 ft over White Sands Missile Test Range, and executed a number of maneuvers including a 180 degree turn to test whether BAT's acoustic sensor could acquire a target even if not pointed directly at it. No live targets were involved in this series of tests. Test schedule extended until June 1995. The BAT program is expected to cost \$2 billion.

In October 1993, Northrop received a \$9.4 million contract to study the feasibility of combining millimeter-wave (MMW) and imaging IR seeker technologies to detect vehicles whose engines have been turned off. The US Army may use this technology in place of Raytheon's IR sensor currently being tested as part of the BAT program.

BAT's development phase has been extended through to 1995. Live warhead test trials are to be conducted in 1994.

AGM-137/MGM-137 TSSAM Tri-Service Standoff Attack Missile first unveiled in

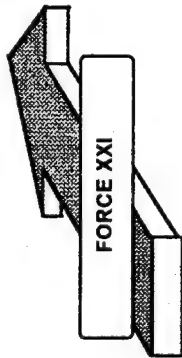
June 1991. Development begun by prime contractor Northrop Corporation in mid-1986s as "Senior Pennant." (Second source is Boeing Company.) Test flights started before 1991; 80% were termed partially or fully successful.

Stealthy configuration with autonomous guidance. Weight approximately 2,300 lb (1,043 kg). The AGM-137 has less than 324-nm (373-mi; 600-km) range and can be flown on B-52 Stratofortress and B-2 Stealth bombers (16 missiles) as well as the A-6 Intruder and the F/A-18 Hornet attack aircraft. MGM-137 has less than 270-nm (311-mi; 500-km) range and can be launched from ATACMs container. Submunitions will include BAT.

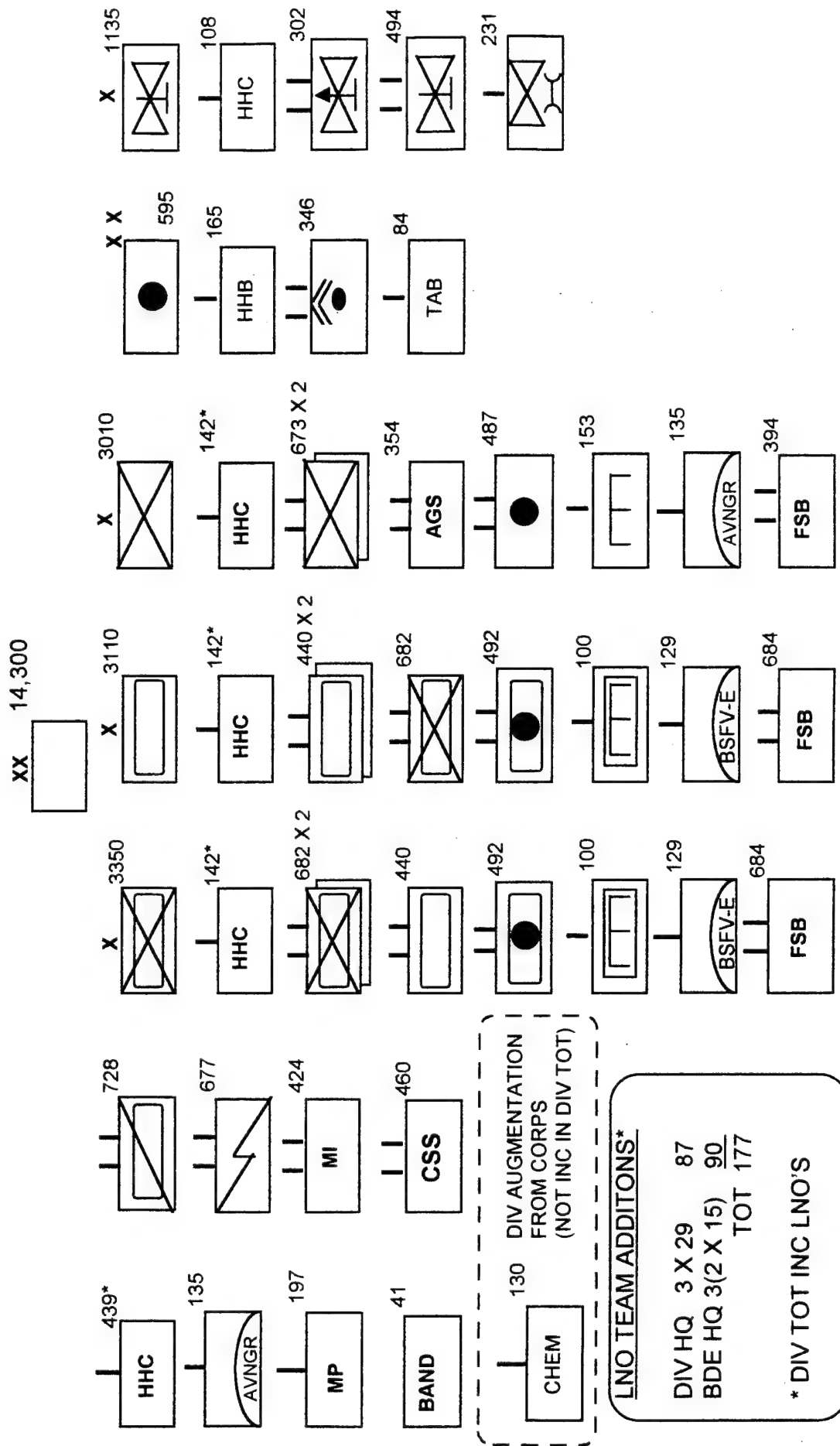
In October 1993, Budget cuts and the Army's dwindling enthusiasm for the TSSAM program have cut planned purchases to 600 from an earlier 1400 missiles. Much of TSSAM's funding has been shifted to the ATACMS improvement program.

AT-2 variant. The AT-2 rocket carries 28 anti-tank mines and is currently under development for German forces.

Nuclear-warhead variant. Theater nuclear weapon with 259 nm (298 mi; 480 km) range (just under the Intermediate Nuclear Forces lower limit of 270 nm (311 mi; 500 km)).<sup>142</sup>



# Appendix 07: ORGANIZATIONAL CONCEPT MODULAR DIVISION - SMALL BASE (OPTION 1)



## Glossary

### Definitions

Artillery. Army or Marine Corps indirect fire systems - cannons, rockets and missiles - command, control and coordination facilities, and target acquisition resources.

Control Measures. Directives given graphically or orally by a commander to subordinate commands in order to assign responsibilities, coordinate fires and maneuver, and to control combat operations. Each control measure can be portrayed graphically, all control measures should be easily identifiable on the ground. Examples of control measures include boundaries, objectives, coordinating points, contact and direction of attack.<sup>143</sup> (also see methods of control)

Depth. The extension of operations in time, space, resources, and purpose. These factors vary by echelon and by constraints given to commanders. What is most important, however, is the fact that in any operation the Army must have the ability to gain information and influence operations throughout the depth of the battlefield. This ability highlights the joint nature of deep operations, which means participation by the other services.<sup>144</sup>

Deep Operations. Those directed against enemy forces and functions beyond the close battle. They are executed at all levels with fires, maneuver, and leadership. Deep operations affect the enemy through either attack or threat of attack. They expand the battlefield in space and time to the full extent of friendly capabilities.

Effective deep operations facilitate overall mission success and enhance protection of the force. The deep battle is designed to nullify the enemy's firepower, disrupt his C<sup>2</sup>, destroy his supplies, and break his morale. A well-orchestrated deep battle may help cause the enemy to be defeated outright or may prevent him from achieving his intended objectives. In conducting simultaneous attacks in depth, Army forces employ long-range, intelligence-acquisition and targeting assets, including electronic warfare and joint assets, to track enemy forces, to complicate their operations, and to determine the effects of our strikes in depth.<sup>145</sup>

Field Artillery Mission. The mission of the Field Artillery is to destroy, neutralize or suppress the enemy by cannon, rocket and missile fires, and to assist in integrating all fire support into combined arms operations.<sup>146</sup>

Field Artillery Roles:

Close Support Fires:

Joint Publication 1-02 - fires placed on the enemy troops, weapons, or positions which, because of their proximity, present the most immediate and serious threat to the supported unit.<sup>147</sup>

Field Manual 6-20 - fires used to engage enemy troops, weapons, or positions that are threatening or can threaten the force in either the attack or the defense. They allow the commander to rapidly multiply combat power effects and shift fires quickly about the battlefield. Close support expands the battlefield depth, erodes the enemy forces, and inflicts damage well beyond direct-fire ranges.<sup>148</sup>

Counterfires - fires used to attack enemy indirect-fire systems, to include mortar, artillery, air defense, missile and rockets systems, observation posts, and command and control facilities. Counterfire allows freedom of action to supported maneuver forces.<sup>149</sup>

Interdiction Fires:

Joint Publication 3-09 - An action to divert, disrupt, delay, or destroy the enemy's surface military potential before it can be used effectively against friendly forces.<sup>150</sup>

Field Manual 6-20 - fires used to disrupt, delay, and destroy enemy forces that, because of range limitations or intervening terrain, cannot fire their primary weapon systems on friendly forces. Interdiction fires create windows for the friendly unit offensive maneuver.<sup>151</sup>

Fighting with Fires. The collective and coordinated employment of the fires of armed aircraft, land- and sea-based indirect fire systems, and electronic warfare systems against ground targets to destroy enemy forces, combat functions, and facilities in pursuit of operational and tactical objectives.

Fires:

Field Manual 101-5-1 - The delivery of all types of ordnance through both direct means, as well as nonlethal means, that contribute to the destruction, disruption, and/or suppression of the enemy, facilitate tactical movement and achieve a decisive impact.<sup>152</sup>

Joint Publication 3-09 - The employment of weapons systems (individually or collectively) against surface targets to achieve the desired strategic,



operational, and tactical effects.<sup>153</sup>

Training and Doctrine Command Pamphlet 525-XX - refers to the use of lethal and non-lethal systems to achieve specific operational or tactical objectives.<sup>154</sup>

Fire Support. The collective and coordinated employment of the fires of armed aircraft, land- and sea-based indirect fire systems, and electronic warfare systems against ground targets to support land combat operations at both the operational and tactical levels. Fire support is the integration and synchronization of fires and effects to delay, disrupt, or destroy enemy forces, combat functions, and facilities in pursuit of operational and tactical objectives. Generating effective firepower against an enemy requires that organic and supporting fires be coordinated with other combat functions such as intelligence, logistics, and battle command. Subordinate systems and processes for determining priorities, identifying and locating targets, allocating fires assets, attacking targets, and assessing battle damage must be fully integrated. Fire support provides for the planning and execution of fires so the right targets are adequately attacked to achieve the commander's intended effects. Fire support is the function that binds fire resources together so that the multiple effects of each asset are synchronized with the force commander's intent and concept of operation.

Fire Support Coordination.

Canadian Definition. Fire support coordination includes the planning and execution of fire so that all targets are adequately covered by an appropriate weapon or group of weapons. To offer competent advice on these aspects to the

supported commander, the artillery commander must be thoroughly familiar with the characteristics of each fire support resource. Thus, his advice will lead to the most efficient use of each agency.<sup>155</sup>

Joint Publication 3-09. Fire support coordination is the continuous process of implementing fire support planning and managing all available fire support assets.... It is a flexible process that must be kept as simple as possible to produce the desired results.<sup>156</sup>

Field Manual 6-20-40. Fire support coordination is the continuous process of implementing fire support planning and managing all available fire support assets to a maneuver force.<sup>157</sup>

Fire Support Coordination Measure. A measure employed by land or amphibious commanders to facilitate the rapid engagement of targets and simultaneously provide safeguards for friendly forces.<sup>158</sup>

Firepower. The amount of fire which may be delivered by a position, unit, or weapon system.<sup>159</sup>

Maneuver:

Joint Publication 1-02 - The [e]mployment of forces on the battlefield through movement in combination with fire, or fire potential, to achieve positional advantage in respect to the enemy in order to accomplish the mission.

Field Manual 100-5 - Refers to the employment of forces through offensive or defensive operations to achieve relative positional advantage over an enemy force to achieve tactical, operational, or strategic objectives.<sup>160</sup>

### Methods of Control:

positive - Provides maximum management of fires through direct observation of the fall of shot on the target by an observer or sensor.

procedural - provides decentralized management through battlefield geometry, FSCMs, synchronization of resources, and prioritization for a balance between force protection and maximum responsiveness.

(Also see control measures)

Nonlinear Operations. Nonlinear operations tend to be conducted from the selected bases of operations (ashore or afloat), but without clearly defined lines of operations.... In such operations, land forces tend to focus more on their assigned objectives and less on their geographic relationship with other friendly forces.<sup>161</sup>

Sensor to shooter linkage. A direct communications channel between the acquisition platform and a designated weapons system.

Supported. The unit receiving additional forces or assistance in support of an operations plan or operations order.

Supporting. The action of a force which aids, protects, complements, or sustains another force in accordance with a directive requiring such action. Forces stationed in, or to be deployed to, an area of operations to provide support for the execution of an operations order.<sup>162</sup>

Supporting Artillery. Artillery which executes fire missions in support of a specific unit, usually infantry, but remains under the command of the next higher artillery commander.<sup>163</sup>

Supporting Fire. Fire delivered by supporting units to assist or protect a unit in combat.<sup>164</sup>

## **BIBLIOGRAPHY**

### **BOOKS:**

- Bellamy, Chris. Red God of War. Soviet Artillery and Rocket Forces. New York: Brassey's Defence Publishers, 1986.
- Camm, Frank A. Evaluating Intelligence Systems that Support Deep Fires. Santa Monica, CA: Rand, 1989.
- Cohen, Eliot A. and John Gooch. Military Misfortunes The Anatomy of Failure in War. The Free Press: New York, 1990.
- Dastrup, Boyd L. The Field Artillery. History and Sourcebook. Westport, Connecticut: Greenwood Press, 1994.
- \_\_\_\_\_. King of Battle. A Branch History of the U.S. Army's Field Artillery. Fort Monroe, Virginia: U.S. Army Training and Doctrine Command, 1992.
- Dubik, James M. and Gordon R. Sullivan. Envisioning Future Warfare. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1995.
- Enquiry Organized by the Inter-Parliamentary Union. What Would War be the Character of a New War ? London: P.S. King & Son, Ltd, 1931.
- Fuller, John Frederick Charles. A Military History of the Western World. vol. 3, From the Seven Days Battle, 1862. To the Battle of Leyte Gulf, 1944. New York: Funk & Wagnalls Company, Inc., 1956.
- \_\_\_\_\_. Memoirs of an Unconventional Soldier. London: Ivan Nicholson and Watson, 1936.
- \_\_\_\_\_. The Foundations of the Science of War. London: Hutchinson & CO. LTD., 1926; a military classic reprint, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1993.
- Gorman, Paul F. The Secret of Future Victories. Alexandria, VA: Institute for Defense Analyses (paper P-2653); a military classic reprint, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1994.
- Hogg, Oliver F. G. Artillery: Its Origin, Heyday and Decline. Hamden, Connecticut: Archon Books, 1970.

Manucy, Albert. Artillery Through the Ages. Washington, DC: US Government Printing Office, 1949.

Marshall, S. L. A. Men against Fire. The Problem of Battle Command in Future War. Gloucester, Mass.: Peter Smith, 1978.

Rogers, H.C.B. A History of Artillery. Secaucus, New Jersey: The Citadel Press, 1975.

Scales, Jr., Robert H., Terry L. Johnson, and Thomas P. Odom. Certain Victory: The US Army in the Gulf War. Office of the Chief of Staff, United States Army. Washington, DC: US Government Printing Office, 1993; a selected reprint, Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1994.

Spiller, Roger J. Combined Arms in Battle Since 1939. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1992.

Sun Tzu. The Art of War. edited by Samuel B. Griffith. New York: Oxford University Press, 1971.

Swain, Richard Moody. "Lucky War" Third Army in Desert Storm. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1994.

The White House. "National Security Strategy of The United States." Washington, DC: US Government Printing Office, 1990.

Zabecki, David T. Steel Wind. Colonel Georg Bruchmuller and the Birth of Modern Artillery. Westport, Connecticut: Praeger Publishers, 1994.

#### **MILITARY PUBLICATIONS:**

B-GL-306-003/FP-001, Field Artillery. Duties of the Battery Commander and the Observer. Volume 3. FMC HQ/SSO Artillery, 1989.

Boyd, Morris J. Doctrine and Force XXI-- Leading the Army into the 21st Century. Deputy Chief of Staff for Doctrine, United States Army Training and Doctrine Command. Prodigy@ Web Browser: Doctrine and Force XXI (<http://204.7.227.67:1100/...-essay/doc&fxi.html>).

Boyd, Morris J. and Michael Woodgred. Force XXI Operations. Prodigy@Web Browser: Military Review Article - Nov 94 (<http://www-cgsc.army.mil/cgsc/boyd.html>).

Chairman of the Joint Chiefs of Staff Manual 3500.04. Universal Joint Task List (UJTL). Washington, DC: US Government Printing Office, May 1995.

Field Manual 6-20. Fire Support in Combined Arms Operations. Washington, DC: US Government Printing Office, 1988.

Field Manual 6-20-2. Tactics, Techniques, and Procedures for Corps Artillery, Division Artillery, and Field Artillery Brigade Headquarters. Washington, DC: US Government Printing Office, 1993.

Field Manual 6-20-20. Tactics, Techniques, and Procedures for Fire Support at Battalion Task Force and Below. Washington, DC: US Government Printing Office, 1991.

Field Manual 6-20-30. Fire Support at Corps and Division. Washington, DC: US Government Printing Office, 1988.

Field Manual 6-20-40. Tactics, Techniques, and Procedures for Fire Support for Brigade Operations (Heavy). Washington, DC: US Government Printing Office, 1990.

Field Manual 6-21. Division Artillery Infantry Division. Washington, DC: US Government Printing Office, 1957.

Field Manual 6-71. Tactics, Techniques, and Procedures for Fire Support for The Combined Arms Commander. Washington, DC: US Government Printing Office, 1994.

Field Manual 27-10. The Law of Land Warfare. Washington, DC: US Government Printing Office, 1956.

Field Manual 71-1. Tank and Mechanized Infantry Company Team. Washington, DC: US Government Printing Office, 1988.

Field Manual 71-3. Armored and Mechanized Infantry Brigade. Washington, DC: US Government Printing Office, 1988.

Field Manual 71-100. Division Operations. Washington, DC: US Government Printing Office, 1990.

Field Manual 71-100-2. Infantry Division Operations, Tactics, Techniques, and Procedures. Washington, DC: US Government Printing Office, 1993.

Field Manual 71-123. Tactics and Techniques for Combined Arms Heavy Forces: Armored Brigade, Battalion/Task Force, and Company/Team. Washington, DC: US Government Printing Office, 1992.

Field Manual 90-14. Rear Battle. Washington, DC: US Government Printing Office, 1985.

Field Manual 90-21. Multi-Service Procedures for Joint Air Attack Team Operations. Washington, DC: US Government Printing Office, 1991.

Field Manual 100-1. The Army. Washington, DC: US Government Printing Office, June, 1994.

Field Manual 100-5. Operations. Washington, DC: US Government Printing Office, June 1993.

Field Manual 100-6 (Coordinating Draft). Large Unit Operations. Washington, DC: US Government Printing Office, May 1987.

Field Manual 100-15. Corps Operations. Washington, DC: US Government Printing Office, 1989.

Field Manual 100-26. The Air-Ground Operations System. Washington, DC: US Government Printing Office, 1973.

Field Manual 100-40 (Authors' Draft). Tactics. Washington, DC: US Government Printing Office, August, 1995.

Field Manual 100-103-1. Integrated Combat Airspace Command and Control. Washington, DC: US Government Printing Office, 1994.

Field Manual 100-103-2. Multiservice Procedures for the Theater Air-Ground System. Washington, DC: US Government Printing Office, 1994.

Field Manual 101-5-1. Operational Terms and Symbols. Washington, DC: US Government Printing Office, 1985.

Field Manual 101-5-1 (Final Draft). Operational Terms and Symbols. Washington, DC: US Government Printing Office, July 1995.

Fleet Marine Force Manual 6-9. Marine Artillery Support. Washington, DC: US Government Printing Office, 1993.

Fleet Marine Force Manual 6-18. Techniques and Procedures for Fire Support Coordination. Washington, DC: US Government Printing Office, 1992.



Hartzog, William W. On the Road to Force XXI. Commanding General, United States Army Training and Doctrine Command. Prodigy@Web Browser: On the Road to Force XXI (<http://204.7.227.67:1100/...-essay/roadfxxi.html>).

Headquarters, United States Army Training and Doctrine Command, Director for Battle Lab Integration, Technology and Concepts. Battle Labs Force XXI ... Defining the Future. Washington, DC: US Government Printing Office, May, 1995.

Headquarters, United States Army Training and Doctrine Command. Corps Deep Operations (ATACMS, Aviation and Intelligence Support) Tactics, Techniques and Procedures Handbook. Washington, DC: US Government Printing Office, 1990.

Headquarters, United States Department of the Army. America's Army of the 21st Century, Force XXI, Meeting the 21st Century Challenge. Office of the Chief of Staff, Army. Washington, DC: US Government Printing Office, January 1995.

Headquarters, United States Department of the Army. Army Focus 94, Force XXI, America's Army in the 21st Century. Washington, DC: US Government Printing Office, September, 1994.

Headquarters, United States Department of the Army. Force XXI Campaign Plan. Office of the Chief of Staff, Army. Prodigy@Web Browser: Force XXI Campaign Plan (<http://204.7.227.67:1100/f21camp.html>).

Headquarters, United States Department of the Army. Louisiana Maneuvers, the First Year. Office of the Chief of Staff, Army, Director, Louisiana Maneuvers Task Force. With a Forward by Gordon R. Sullivan and Togo D. West, Jr.. Washington, DC: US Government Printing Office, March, 1994.

Headquarters, United States Department of the Army. Firing Tables, FT 155-AM-2. Washington, DC: US Government Printing Office, 1983.

Headquarters, United States Department of the Army. Weapons Systems. Washington, DC: US Government Printing Office, 1995.

Herbert, Paul H. Deciding What has to Be Done: General William E. Depuy and the 1976 Edition of FM 100-5, Operations. Combat Studies Institute, Leavenworth Papers, Number 16. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1988.

Historical Trends Related to Weapons Lethality. by the Historical Evaluation and Research Organization (Contract Number DA 30-069-AMC-647(X)) (Annex I). Washington, DC: US Government Printing Office, 1964.

Joint Publication 1-02. Department of Defense Dictionary of Military and Associated Terms. Washington, DC: US Government Printing Office, 1994.

Joint Publication 3-0. Doctrine for Joint Operations. Washington, DC: US Government Printing Office, 1993.

Joint Publication 3-09 (Second Draft). Doctrine for Joint Fire Support. Washington, DC: US Government Printing Office, 1995.

Miller, John E. Force XXI Battle Command. Deputy Commander United States Army Training And Doctrine Command. Prodigy@Web Browser: Force XXI Battle Command (<http://204.7.227.67:1100/...v-essay/bcessay.html>).

Perry, William J. Annual Report to the President and the Congress. Washington, DC: US Government Printing Office, February, 1995.

Sullivan, Gordon R. Force XXI--America's 21st Century Army. Prodigy@Web Browser: Force XXI America's 21st Army (<http://204.7.227.67:1100/.../jv-essay/fxxi3.html>), June, 1995.

\_\_\_\_\_. Building the Force for the 21st Century -- Force XXI. Prodigy@Web Browser: Force XXI (<http://204.7.227.67:1100/...mission/mission.html>), February, 1995.

Synchronization Methodology to the Force XXI Campaign Plan. Annex A. Prodigy@Web Browser: Synchronization Methodology (<http://204.7.227.67:1100/synch/methods.html>).

TA01GN. Fire Support Tactics and Techniques Combined Arms Team. Fort Sill, Oklahoma: Field Artillery School Tactics and Combined Arms Department, 1987.

Training and Doctrine Command Pamphlet 525-5. Force XXI Operations. Washington, DC: US Government Printing Office, 1994.

Training and Doctrine Command Pamphlet 525-200-1. Battle Command. Washington, DC: US Government Printing Office, 1 December, 1994.

- Training and Doctrine Command Pamphlet 525-200-2. Early Entry Lethality and Survivability. Washington, DC: US Government Printing Office, 1 March, 1994.
- Training and Doctrine Command Pamphlet 525-200-3. Dismounted Battlespace. Washington, DC: US Government Printing Office, 1 June, 1994.
- Training and Doctrine Command Pamphlet 525-200-4. Mounted Battlespace. Washington, DC: US Government Printing Office, 1 June, 1994.
- Training and Doctrine Command Pamphlet 525-200-5. Depth and Simultaneous Attack. Washington, DC: US Government Printing Office, 1 June, 1994.
- Training and Doctrine Command Pamphlet 525-200-6. Combat Service Support. Washington, DC: US Government Printing Office, 1 August, 1994.
- Training and Doctrine Command Pamphlet 525-XX. Force XXI Division Operations Concept. Washington, DC: US Government Printing Office, 19 May 1995.
- Training Circular Number 6-40. Field Artillery Manual Cannon Gunnery. Washington, DC: US Government Printing Office, 27 December, 1988.
- Training Circular Number 25-1. Training Land. Washington, DC: US Government Printing Office, August, 1978.
- United States Army Command and General Staff College. Fundamentals of Tactical Operations. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, February 1994.
- United States Army Field Artillery Center and School, Directorate of Combat Developments. Program and Project Summary Sheets. Fort Sill, Oklahoma: United States Army Field Artillery Center and Fort Sill, 1 May 1995.
- U.S.N.I. Military Database, Missiles/Rockets - Land Attack/Theater - ATACMS. Provided by the United Communications Group and The U.S. Naval Institute. Edition 05/01/95. Copyright 1991 by United Communications Group, 11300 Rockville Pike, Suite 1100, Rockville, Md.

### ARTICLES

"Army Weaponry and Equipment." Army. 10 (October 1995): 217 - 320.

- Baxter, Leo. J. "Field Artillery, Vision 2020." Field Artillery Journal. HQDA PB6-94-5 (November-December 1994): 10.
- Gourley, Scott R. "Extending the Range of Rockets and Missile Systems." ARMY. 6 (June 1995): 36 - 42.
- \_\_\_\_\_. "Vision 2020." ARMY. 2 (February 1995): 41 - 44.
- Dye, Harold A. "Close Fire Support." The Journal Of The Royal Artillery, 1 (March 1968): 18-22.
- Fronzaglia, Robert J. "The Paladin Battalion at the NTC - A Commander's Perspective." Field Artillery Journal. HQDA PB6-95-4 (September-October 1995): 12-16.
- Kemp, Ian, "Towed Artillery, For Rapid Reaction, Might is Light!" Jane's Defence Weekly. 12 (23 September 1995): 21-26.
- Naylor, Sean D. "Three Options for Four Stars." Army Times, 16 October 1995, 12 - 14.
- Noble, Earl D. and Kurt A. Meisenzahl. "AFATDS, The FA's Doorway to the Digital Battlefield." Field Artillery Journal. HQDA PB6-95-4 (September-October 1995): 36-39.
- Ohle, David H. "The Campaign Plan." Army. 2 (February 1995): 19 - 20.
- Rigby, Randall L. "Fires for Division XXI: State of the Branch 1995." Field Artillery Journal. HQDA PB6-95-5 (November-December 1995): 1-5.
- Rittenhouse, C. William. "Army Science Board: Maneuver Art versus FA Science." Field Artillery Journal. HQDA PB6-95-4 (September-October 1995): 2.
- Salomon, Leon E. "Army Materiel Command: Providing the Technological Edge." Army. 2 (February 1995): 25 - 28.
- Schneider, James J. "The Theory of the Empty Battlefield." Journal of the Royal United Services Institute for Defense Studies. 3 (September 1987): 37-44.
- Starr, Barbara. "Arsenal Ship offers a warfighting Revolution." Jane's Defence Weekly. 12 (23 September 1995): 6.
- Stewart, William G., "Interaction of Firepower, Mobility, and Dispersion." Military Review. XXXIX (March 1960): 26-33.

## **MONOGRAPHS and THESES**

Brehm, Norman R. Evolving Field Artillery Standard Tactical Missions for Force XXI. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1995.

Corpac, Peter S. Airland Battle Future - Fires: How Do You Do It?. Fort Leavenworth, KS: School of Advanced Military Studies USACGSC, 1991.

Crawford, Darrell E. Deep Operations in Airland Battle Doctrine: The Employment of U.S. Ground Forces in Deep Operational Maneuver. Fort Leavenworth, KS: School of Advanced Military Studies, USACGSC, 1989.

House, Jonathan M. Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine and Organization. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College Press, 1984.

Kelly, Patrick. Modern Scientific Metaphors of Warfare: Updating the Doctrinal Paradigm. Fort Leavenworth, KS: School of Advanced Military Studies, USACGSC, 1993.

M<sup>c</sup>Meen, Scott R. Field Artillery Doctrine Development 1917 - 1945. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, 1991.

Pickar, Charles K. Tactical Deep Battle: The Missing Link. Fort Leavenworth, Kansas: School of Advanced Military Studies, USACGSC, 1991.

Schneider, James J. Vulcan's Anvil: The American Civil War and the Emergence of Operational Art. Theoretical Paper Number Four, Fort Leavenworth, Kansas: School of Advanced Military Studies, USACGSC, 1991.

Swan, Robin P. The Pieces of a Chessboard - What is the Contemporary Significance of Jomini's Design of a Theater of Operations?. Fort Leavenworth, KS: School of Advanced Military Studies USACGSC, 1991.

## **UNPUBLISHED MATERIAL**

After Action Report from the Mobile Strike Force, Exercise Priarie Warrior, 1995. U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, 1995.

Baxter, Leo. Field Artillery for Force XXI. Speech given to the Field Artillerymen of the United States Army Command and General Staff College Class of 1995. Fort Leavenworth, Kansas, 1994.

Field Standard Operating Procedures (FSOP). Deep operations Annex. (Vth Corps Artillery Headquarters (AETV-AT-GC), April 1995), D-1.

Shaping the Deep Battlefield Synchronized Operations in the Air Assault Division. Division Fire Support Element, 101st Airborne Division (Air Assault), 28 April, 1992.

Tactical Standard Operating Procedures (TACSOP). Vth Corps Artillery Headquarters (AETV-AT-GC), Undated.

United States Army Command and General Staff College, Corps and Division Doctrine Division. Military Decision Making Process White Paper. U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, 20 September, 1995.

United States Army Command and General Staff College, Corps and Division Doctrine Division. Battlefield Framework White Paper. U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, 24 June, 1995.

### **INTERVIEWS**

Aponte, Manny, Assistant TRADOC Systems Manager - Cannon, Directorate of Combat Developments. Interview by the Author, 19-20 December 1995, Fort Leavenworth, Kansas. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

Chusano, Wayne M. Action Officer for the Task Force AWE, "Field Artillery Support in the Task Force XXI," 4 December 1995, Fort Sill, OK. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

Grau, Lester W. , Analyst in the Foreign Military Studies Office. Interview by Author, 7 September 1995, Fort Leavenworth, Kansas. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

Otis, Glenn K., "Ascendancy of Fires, The Evolution of the Combined Arms Team." Interview by The Field Artillery Journal Staff. The Field Artillery Journal, HQDA PB6-95-3 (June 1995): 18-19.

Springman, Jeffrey, Scenario Team Chief, TRADOC Analysis Center (TRAC), Scenario Wargaming Center. "Divison Design Analysis." Interview by Author, 28 September through 12 December 1995, Fort Leavenworth, Kansas. Verbal Interview. Fort Leavenworth, Kansas: School of Advanced Military Studies.

## **CONFERENCES**

The Future of Warfare. Inaugural Annual Conference of The James A. Baker III  
Institute at Rice University on "C-SPAN", 26 November, 1995.

## INITIAL DISTRIBUTION LIST

1. Combined Arms Research Library  
U.S. Army Command and General Staff College  
Fort Leavenworth , KS 66027-6900
2. Defense Technical Information Center  
Cameron Station  
Alexandria, VA 22314
3. Commander  
US Army Field Artillery Center and Fort Sill  
Task Force 2000  
ATTN: LTC Carafano  
Fort Sill, OK 73503
4. Commander  
USAAVNC  
Directorate of Combat Developments  
ATTN: ATZQ TDS D (MAJ Steve Greenberg)  
Fort Rucker, AL 36362-5000
5. Commander  
USACAC  
Battle Command Battle Lab  
ATTN: ATZL TP (Mr. Thomas L. Douthitt)  
Fort Leavenworth, KS 66027-5300
6. Commander  
US Army Field Artillery Center and Fort Sill  
Depth and Simultaneous Attack Battle Lab  
ATTN: COL Cunningham  
Fort Sill, OK 73503
7. Commander  
USACAC, USACGSC  
Center for Army Leadership  
ATTN: LTC Joel A. Buck  
Fort Leavenworth, KS 66027-5300



8. Commander  
USACAC, USACGSC  
Combat Doctrine Directorate  
ATTN: ATZL-SWW (Mr. David E. Turek)  
Fort Leavenworth, KS 66027-5300
9. Commander  
USACAC, USACGSC  
CTAC  
ATTN: LTC Grier  
Fort Leavenworth, KS 66027-5300
10. Commander  
USACAC  
Director TRAC  
ATTN: SWC (MAJ Jeff Springman)  
Fort Leavenworth, KS 66027-5300
11. Commander  
USACAC, USACGSC  
CTAC  
ATTN: LTC Pete Zielinski  
Fort Leavenworth, KS 66027-5300
12. Commander  
24th Infantry Division Artillery (M)  
ATTN: COL Wood  
Fort Stewart, GA 31314
13. Commander  
US Army Field Artillery Center and Fort Sill  
Director of Combat Developments  
ATTN: ATSF-CN (MAJ Manny Aponte)  
Fort Sill, OK 73503-5601
14. Program Executive Office -- Tactical Missiles  
SFAE-MSL-I (M. Bartlett)  
Redstone Arsenal, AL 35898-8000